

SECTION 600 – INCIDENTAL CONSTRUCTION**SECTION 601 – GUARDRAIL****601.01 Description**

This work shall consist of the fabrication, assembly, and installation of guardrail, guardrail transitions, and guardrail end treatments, in accordance with these requirements, and as shown on the plans. This work may also consist of the extension of existing guardrail with new guardrail, the removal of existing guardrail, or adjusting the height of existing guardrail.

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MATERIALS**601.02 Materials**

Materials shall be in accordance with the following:

Rail Accessories, Fittings, and Hardware.....	910.11
Steel Guardrail Posts	910.10
Steel Thrie-Beam Rail	910.09
Steel W-Beam Rail	910.09
Timber Posts and Blocks	911.02(f)

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All guardrail, post, accessories, fittings, and hardware shall be supplied from a source listed on the Department's list of approved Certified Guardrail Suppliers in accordance with 910.12. Guardrail end treatments shall be selected from the Department's list of approved Guardrail End Treatments in accordance with 601.07 and impact attenuators shall be selected from the Department's list of Approved Impact Attenuators in accordance with 601.08.

PCC in anchors and in pads or bases for impact attenuators shall be class A and in accordance with 702. Sheet signs and sign posts shall be in accordance with 802.

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Barrels used in impact attenuators shall be yellow with black lids. The aggregate used in the barrels shall be uncrushed gravel, class F or higher, in accordance with 904 and the following gradation requirements.

<u>Sieve Size</u>	<u>% Passing</u>
1/2 in. (12.5 mm)	100
No. 50 (300 µm)	0-5
No. 100 (150 µm)	0-2

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All other impact attenuators shall have end reflectorization as shown on the plans or attached to the nose of the attenuator in accordance with the attenuator manufacturer's recommendation.

Thrie beam guardrail elements shall be steel and shall be in accordance with the applicable requirements for steel beam guardrail shown in 910.09, 910.10, 910.11, and 910.12.

50 The components, assembly, post spacing, post lengths, and installation for each location shall be as shown on the plans. Double-facing of the guardrail will be required at the locations shown on the plans. In locations where conditions will not allow the use of 7 ft (2130 mm) posts, 6 ft (1830 mm) posts may be substituted when approved.

The base metal thickness of the steel W-beam rail element for a curved guardrail system shall be 0.105 in. (3 mm). The base metal thickness of the steel W-beam terminal connector shall be 0.138 in. (3.5 mm). The wood breakaway posts shall be S4S timber and shall otherwise be in accordance with 911. The curved rail timber posts shall be in accordance with 911. All structural tubing shall be in accordance with ASTM A 500. The remaining steel components shall be in accordance with 910.

CONSTRUCTION REQUIREMENTS

601.03 General Requirements

Posts shall be installed plumb at the spacing and embedment depth shown on the plans. Posts shall be driven where subsurface conditions permit the use of normal driving equipment. Where subsurface conditions prohibit driving the posts, a 12 in. (300 mm) diameter hole shall be bored to the required embedment depth. The hole shall be backfilled with suitable material in 6 in. (150 mm) maximum lifts, 70 compacted as directed, and then the posts driven.

Posts damaged during installation shall be repaired or replaced as directed with no additional payment.

When new guardrail is being installed to replace existing guardrail and traffic is to be maintained during the work, the installation of the new guardrail shall follow the removal of the existing guardrail as closely as practical. Adequate safety protection shall be provided as directed between the time that the existing guardrail is removed and the time that the installation of the new guardrail is completed.

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When new guardrail is being installed where there is no existing guardrail and traffic is to be maintained during the work, the mounting of the blocks and the rail elements to the posts shall be completed as soon as practical after the posts are installed. The time between the installation of the posts and the mounting of the blocks and rail elements shall not exceed 24 h. Drums shall be placed to mark all installed guardrail posts left bare overnight. The spacing of these devices shall be numerically equal to the worksite speed limit, but not less than 20 ft (6 m).

90 All damaged galvanized surfaces shall be coated in accordance with 910.11(a)4.

601.04

The nested W-beam guardrail element shall consist of two rail elements, one set inside the other. The length of nested guardrail placed over a culvert shall not be spliced.

601.04 Guardrail Erection

Blocks and rail elements shall be erected in a manner resulting in a smooth, continuous installation. All bolts shall be of sufficient length to extend beyond the nuts and shall be drawn tight. Rail installed along a radius of 150 ft (46 m) or less shall be shop curved. Rail elements shall be lapped as shown on the plans.

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601.05 Curved W-Beam Guardrail Systems

This work shall consist of the fabrication, assembly, and installation of specified types of curved W-beam guardrail connector system or curved W-beam guardrail terminal system in accordance with the requirements herein and as shown on the plans.

The installation of the terminal end buffer may utilize an alternate single piece having similar dimensional shape to the terminal end buffer as shown on the plans, and which mates with the W-beam guardrail.

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Where the W-beam terminal connector is lapped on the outside of the guardrail, a galvanized 1 in. (25 mm) inside diameter, 2 in. (50 mm) outside diameter, 0.134 in. (3.4 mm) thick, narrow plain washer shall be placed under the splice bolt heads.

Nuts for the anchor cable assembly shall be hand tightened, plus one complete turn at the anchor plate end. All other nuts shall be torqued to 50 ft lb (67.8 Nm).

The installation of the type 5 anchor shall include tightening the cable with the swaged end to eliminate all slack.

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The W-beam rail in the type 5 anchor shall be attached to the steel pipe with 5/8 in. (M16) diameter x 1 1/4 in. (32 mm) button head bolt with no washer. Connection to the post will not be required.

601.06 Guardrail Transitions

Guardrail transitions shall be required to connect guardrail to bridge rail, guardrail to piers, and new W-beam guardrail to existing rub rail type guardrail. The required type of guardrail transition shall be as shown on the plans. The fabrication, assembly, and installation of thrie-beam components and timber posts and blocks for guardrail transitions will be required for the locations shown on the plans.

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601.07 Guardrail End Treatments

Guardrail end treatments shall be required to terminate guardrail installations at the locations shown on the plans. The type I guardrail end treatment shall be either as shown on the plans, or shall be selected from the Department's list of approved Guardrail End Treatments. The type II guardrail end treatment shall be as shown on

the plans. The type OS or MS guardrail end treatments shall be selected from the Department's list of approved Guardrail End Treatments. The reflectorization of guardrail end treatments, and the grading requirements shall be as shown on the plans.

Double facing of guardrail end treatment type I will be required when it is used in conjunction with double faced guardrail.

Each unit shall be installed in accordance with the manufacturer's recommendations.

Assembly and installation shall be supervised or performed at all times by an installer trained and certified by the unit's manufacturer, and shall be in accordance with the manufacturer's recommendations at the locations shown on the plans. A copy of the installer's certificate shall be provided to the Engineer prior to the start of the work.

The Contractor shall provide the Department with original copies of all necessary current manufacturer's installation manuals and shop drawings prior to beginning installation work. Shop drawings shall be a minimum of 22 by 34 in. (550 by 850 mm) in size. No installation work shall begin prior to the Department's receipt of such manuals and drawings. Such manuals and drawings will remain the property of the Department. If there is a discrepancy between the shop drawings and the plans, the shop drawings shall govern.

When installing end treatments to existing rub rail type guardrail, the rub rail, if not spliced at the last existing post, shall be cut and the end repositioned behind the flange of the post. If the rub rail is spliced at the last existing post, the existing splice material shall be removed and the end of the rub rail repositioned behind the flange of the post. In both cases, the rub rail shall be connected to the post as shown on the plans.

Guardrail end treatments shall be installed within 24 h of the completion of the guardrail installation to which they are to be attached. Drums in accordance with 801.09 shall be placed for overnight marking of the bare end of the guardrail when the installation of the guardrail end treatment will not be completed until the day following the completion of the guardrail installation to which it is to be attached.

601.08 Impact Attenuators

Impact attenuators shall be placed or reset to obtain the proper height where shown on the plans. The unit for each new location shall be of the width recommended by the manufacturer and for the test level specified and shall be chosen from those shown on the Department's list of approved Impact Attenuators. Each unit shall be placed in accordance with the manufacturer's recommendations, on a PCC pad.

Assembly and installation or resetting shall be supervised or performed at all times by an installer trained and certified by the unit's manufacturer, and shall be in accordance with the manufacturer's recommendations at the locations shown on the plans. A copy of the installer's certificate shall be provided to the Engineer prior to the start of work.

190 The Contractor shall provide the Department with original copies of all necessary current manufacturer's installation manuals and shop drawings prior to beginning installation work. Shop drawings shall be a minimum of 22 by 34 in. (55 by 850 mm) in size. No installation work shall begin prior to the Department's receipt of such manuals and drawings. Such manuals and drawings will remain the property of the Department. If there is a discrepancy between the shop drawings and the plans, the shop drawings shall govern.

200 Transition panels and all other necessary hardware shown in the manufacturer's recommendations to be required for bi-directional traffic protection shall be included in the installation or resetting, if the unit is installed at a location where traffic is passing the unit on both sides in opposite directions.

If a spare parts package is required for the unit being installed, such package shall consist of those parts which are shown on the list provided by the manufacturer. The spare parts shall correspond to those shown on the list for the unit to be placed. The package shall be delivered to the location directed and will become the property of the Department.

210 Impact attenuators may be placed on the Department's approved list based on the manufacturer's documentation subject to the Department's acceptance. The manufacturer shall provide a copy of the test report stating that its product fully complies with the requirements of NCHRP 350 crash test level 3, and that its product has been approved by the FHWA. Products will be maintained on the Department's approved list by a manufacturer's certification submitted annually in October and the Department's continued acceptance. This certification shall state that the product has not been changed since the NCHRP 350 crash testing, that the NCHRP 350 test results still apply to this product, and that the FHWA approval is still applicable.

601.09 Extension of Existing Guardrail

220 Extension of existing rub rail type guardrail with new W-beam guardrail shall require adjusting the post heights in the last 25 ft (8 m) of existing rub rail type guardrail adjacent to the extension as shown on the plans. Guardrail transition type VH shall be used to make this adjustment. The post spacing of the guardrail transition type VH shall equal that of the last 25 ft (8 m) of existing rub rail type guardrail adjacent to the extension. The rub rail shall be terminated at the last existing post in the transition in accordance with 601.06.

601.10 Removal of Existing Guardrail

Removal of existing guardrail shall be in accordance with the applicable requirements of 202 and these requirements. The locations shall be as shown on the plans. When it is specified that the removed guardrail is to become the property of the Department, the rail elements, posts, and blocks shall be removed without being damaged. The removed material shall be stored as directed.

601.11 Adjusting Existing Guardrail Height

The height of the existing guardrail shall be adjusted by the use of moveable blocks as shown on the plans. The height shall be measured to the top of the rail element along the face of the rail. Existing fixed blocks shall be replaced with moveable blocks installed at the proper height. Existing moveable blocks shall be disconnected from the posts and re-mounted at the proper height.

601.12 Resetting Guardrail

This work shall consist of the removal of existing guardrail and, and if necessary, storing it, and then re-erecting it where shown on the plans or as directed.

601.13 Method of Measurement

Guardrail, guardrail with rub rail, shop curved guardrail, adjusting guardrail height, guardrail removal, and resetting guardrail will be measured by the linear foot (meter) along the top of the rail element, complete in place. Nested guardrail will be measured per each 100 lft (30.48 m) run placed. Modified posts for nested guardrail will be measured per each, complete in place. Guardrail transitions, W-beam guardrail cable terminal anchors, and guardrail end treatments will be measured per each, complete in place. Guardrail buried end treatments type II will be measured per each. Impact attenuators, reset impact attenuators, and impact attenuator spare parts packages will be measured per each for the type and width and test level, complete in place. The curved W-beam guardrail connector system and the curved W-beam guardrail terminal system will be measured per each for the type specified. Grading at guardrail end treatments, the reflectorization of guardrail end treatments, and concrete used in anchoring guardrail end treatments will not be measured for payment.

601.14 Basis of Payment

W-beam guardrail will be paid for at the contract unit price per linear foot (meter) for the specified post spacing. Thrie-beam and thrie-beam double faced guardrail will be paid for at the contract unit price per linear foot (meter) for guardrail, thrie-beam and guardrail, thrie-beam, double faced, complete in place. Nested guardrail will be paid for at the contract unit price per each 100 lft (30.48 m) run, complete in place for guardrail, W-beam, nested. W-beam guardrail cable terminal anchor will be paid for at the contract unit price per each, complete in place. Modified posts for nested guardrail will be paid for at the contract unit price per each for modified posts, nested guardrail. W-beam guardrail with rub rail will be paid for at the contract unit price per linear foot (meter) for guardrail, WR-beam complete in place. Shop curved guardrail, adjusting guardrail height, guardrail removal, and

resetting guardrail will be paid for at the contract unit price per linear foot (meter). Guardrail transitions and guardrail end treatments will be paid for at the contract unit price per each for the type specified. Guardrail buried end treatments type II will be paid for at the contract unit price per each, complete in place. Impact attenuators, reset impact attenuators, and impact attenuator spare parts packages will be paid for at the contract unit price per each for the type and width, and test level specified. The curved W-beam guardrail connector system and curved W-beam guardrail system will be paid for at the contract unit price per each for the type specified, complete in place.

Where existing guardrail height is adjusted, such work will be paid for at the contract unit price per linear foot (meter). The cost of removal, all necessary storage, new adjustable post brackets, attachment of rail section, and miscellaneous nuts and bolts as required shall be included in the cost of adjust guardrail height.

Payment will be made under:

	Pay Item	Pay Unit Symbol
	Guardrail, Adjust Height	LFT (m)
	Guardrail Connector System, W-Beam, Curved, _____ type	EACH
	Guardrail End Treatment, _____ type	EACH
	Guardrail, Remove	LFT (m)
	Guardrail, Reset LFT (m)	
	Guardrail, Terminal System, W-Beam Curved, _____ type	EACH
	Guardrail Transition, VH, ____ ft ____ in. (m) Spacing.....	EACH
	Guardrail, Thrie-Beam	LFT (m)
	Guardrail, Thrie-Beam, Double Faced	LFT (m)
	Guardrail, Transition, _____ type	EACH
	Guardrail, W-Beam, ____ ft ____ in. (m) Spacing	LFT (m)
	Guardrail, W-Beam, Cable Terminal Anchor.....	EACH
	Guardrail, W-Beam, Double Faced, _____ ft (m) _____ in. Spacing	LFT (m)
	Guardrail, W-Beam, Nested	EACH
	Guardrail, W- Beam, Shop Curved, _____ ft ____ in. (m) Spacing	LFT (m)
	Guardrail, WR-Beam.....	LFT (m)
	Impact Attenuator, _____, _____ type-width test level	EACH
	Impact Attenuator, Reset, _____, _____ type-width test level	EACH

	Impact Attenuator Spare Parts Package, _____	
	type-width	
320	_____	EACH
	test level	
	Modified Posts, Nested Guardrail	EACH

The substitution of 6 ft (1830 mm) posts for 7 ft (2130 mm) posts where conditions will not allow the use of the longer post will be at the same contract unit price of the longer post.

330 The cost of resetting guardrail shall include the removal, necessary storage, resetting and replacement of damaged or missing parts and new posts as required.

The cost of reflectorization of impact attenuators and guardrail end treatments shall be included in the respective pay items.

The cost of all grading required for the guardrail buried end treatment shall be included in the cost of guardrail end treatment, type II.

The cost of earthwork, grading, and transition panel if required, and PCC pad shall be included in the cost of impact attenuator.

340 The cost of excavation, concrete footings, reinforcement, and structural steel tubing required for modified posts, nested guardrail, shall be included in the cost of the pay item.

The cost of all materials, including replacing damaged or missing parts, labor, and necessary incidentals required to reset impact attenuators, will be included in the cost of impact attenuator, reset.

350 Where guardrail transition type TGB is used with bridge railing type TR, the cost of eliminating the three-beam terminal connector and driving the posts to the height above ground shown on the plans shall be included in the cost of the guardrail transition.

SECTION 602 – CONCRETE BARRIER

602.01 Description

This work shall consist of the construction of concrete barriers and concrete glare screens in accordance with these specifications, and as shown on the plans.

MATERIALS

602.02 Materials

10 Materials shall be in accordance with the following:

	Barrier Delineators	926.02(c)
	Bridge Deck Overlay Materials	722.04
	Cast-in-Place Barriers	702
	Cast-in-Place Concrete Glare Screens	702
	Construction Warning Lights	923.03
	Penetrating Sealer	709, 909.09
	Precast Barriers	707
	Precast Concrete Glare Screen	707
20	Reinforcing Steel	910.01

CONSTRUCTION REQUIREMENTS

602.03 Concrete Barrier and Concrete Glare Screen

Concrete barrier and concrete glare screen may be precast or cast-in-place. The option selected shall be used continuously throughout the project. Irregular sections shall be cast-in-place regardless of the option selected.

- Concrete glare screen may only be precast when constructed in combination
 30 with new precast barrier. Concrete glare screen shall be cast-in-place when constructed in combination with cast-in-place barrier, and also when constructed on top of existing concrete barrier.

Excavation and compaction shall be in accordance with 605.03(a). Backfilling shall be in accordance with applicable requirements of 605.03(d).

(a) Precast Concrete Barrier and Concrete Glare Screen

- Precast concrete barrier and concrete glare screen shall be constructed in accordance with applicable requirements of 707, except the minimum 28 day
 40 compressive strength shall be 3000 psi (20.7 MPa). The precast units shall not be shipped or used until this strength is attained. The surfaces of individual precast units shall vary no more than 0.25 in. (6 mm) in 10 ft (3 m) from the specified cross section, as measured from a longitudinal straightedge. The maximum variation in the vertical and horizontal alignment of adjacent units shall be 0.25 in. (6 mm) across the joint, as measured from a 10 ft (3 m) longitudinal straightedge. Approved bedding may be used to obtain proper alignment of the concrete barrier sections.

(b) Cast-in-Place Concrete Barrier and Concrete Glare Screen

- Cast-in-place concrete barrier and concrete glare screen shall be constructed in
 50 accordance with applicable requirements of 706.03 or by the use of an approved slip-form machine. The surfaces of the concrete shall vary no more than 0.25 in. (6 mm) in 10 ft (3 m) from the specified cross section, as measured from a longitudinal straightedge. Where concrete pavement or concrete shoulder abuts the concrete barrier, 0.5 in. (12 mm) preformed joint filler shall be placed as shown on the plans.

Where the concrete barrier is to be placed on PCCP, epoxy coated reinforcing steel shall be placed as shown on the plans. The epoxy coated reinforcing steel shall be installed in the PCCP by drilling and grouting.

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The barrier wall shall be constructed in single pours without subsequent vertical extensions.

(c) Finishing

Concrete barrier and concrete glare screen shall be finished in accordance with 702.21. If slip-form construction is used, an approved brush finish will be permitted. Curing material in accordance with 912.01(e) shall be applied as a bond breaker to all areas which result in concrete to concrete contact. It shall be applied at a minimum rate of 1 gal./75 sq ft (1 L/1.8m²). If material is applied at a rate less than the minimum rate, a second application shall be applied.

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(d) Sealing

Regardless of the method of construction, all exposed surfaces of the concrete barrier and concrete glare screen shall be sealed in accordance with the applicable requirements of 709.

(e) Joints

The type, size and location of joints and preformed joint filler shall be as shown on the plans.

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(f) Reflectorization

All concrete barrier shall be reflectorized with barrier delineators spaced a minimum of 40 ft (12 m) apart and centered 2 ft (600 mm) above the surface of adjacent pavement or shoulder. The reflectorization shall be on both sides of the wall if traffic is on both sides. All delineators damaged during installation or placement of the concrete barrier shall be replaced with no additional payment. The color of the reflectors shall match the color of the adjacent pavement traffic markings.

602.04 Blank

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602.05 Method of Measurement

Concrete barrier will be measured by the linear foot (meter) along the centerline of the barrier, including irregular barrier sections around median obstructions such as bridge piers. Barrier delineators will be measured per each provided there is a pay item shown in the Schedule of Pay Items. Concrete glare screen will be measured by the linear foot (meter) along the centerline of the glare screen.

602.06 Basis of Payment

Concrete barrier will be paid for at the contract unit price per linear foot (meter), complete in place. Barrier delineators used on concrete barrier will be paid for at the contract unit price per each, complete in place.

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Concrete glare screen will be paid for at the contract unit price per linear foot (meter), complete in place.

Payment will be made under:

	Pay Item	Pay Unit Symbol
110	Barrier Delineator.....	EACH
	Concrete Barrier	LFT (m)
	Concrete Barrier Glare Screen.....	LFT (m)

The cost of polyethylene film, surface seal or curing-sealing material for concrete barrier and curing material shall be included in the cost of concrete barrier.

SECTION 603 – FENCES

603.01 Description

This work shall consist of the construction of fence and gates in accordance with 105.03.

603.02 Materials

Materials shall be in accordance with the following:

10	Barbed Wire	910.18(b)4
	Chain Link Fabric.....	910.18(b)
	Concrete, Class B	702
	Concrete, Packaged Dry	901.08
	Farm Field/Woven Wire.....	910.18(a)
	Fence Posts	910.13
	Gates.....	910.18(d)
	Tension Wire	910.18(b)1

CONSTRUCTION REQUIREMENTS

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603.03 General Requirements

Clearing and grubbing shall be in accordance with 201.03.

At locations where breaks in a run of fencing are required, or at intersections with existing fences, appropriate adjustment in post spacing shall be made in accordance with the requirements for the type of closure indicated.

When the plans require that posts, braces, or anchors be imbedded in concrete, temporary guys or braces shall be installed, if required to hold the posts in proper position. Unless otherwise permitted, no materials shall be installed on posts or strain placed on guys and bracing set in concrete until 96 hours have elapsed from the time of placing of the concrete.

The tops of all posts shall be set to the required grade and alignment. Cutting of the posts will only be allowed with the approval of the Engineer. Post caps shall be installed at the time the fence fabric is placed on the posts.

Wire or fencing of the size and type required shall be firmly attached to the posts and braces in the manner indicated. All wires shall be stretched taut and
40 installed to the required elevations.

At each location where an electric transmission, distribution, or secondary line crosses any of the types of fences covered by these specifications, a ground, conforming to applicable requirements of the National Electric Safety Code, shall be furnished and installed.

603.04 Setting Posts

Posts, including the concrete foundation for posts, braces and anchors shall be set so that the entire fence is inside the right-of-way and the fence can be placed on
50 the side of the post facing the roadway. If an object, such as a tree, is located on the right-of-way and is to remain in place, the fence may be adjusted to miss the obstruction. There shall be a gradual offset for at least three posts in each direction of the obstruction.

Line posts for farm field type fence shall be set on 16 ft (5 m) centers, and for chain link fence on 10 ft (3 m) centers. In either case, a tolerance of ± 2 ft (0.6 m) in spacing will be allowed at special locations as approved. Spacing of these posts shall be as uniform as practicable under the existing conditions. However, additional posts shall be set to maintain the bottom clearance dimensions as required.
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Pull posts shall be set at 500 ft (150 m) maximum intervals in straight runs and at each vertical angle point of 10 degrees or more.

Corner posts shall be set at each horizontal angle point of 10 degrees or more.

End, corner, and pull posts for both types of fence, line posts for chain link fence and diagonal braces for farm field type fence shall be set in concrete as shown on the plans.

70 Except where rock is encountered, intermediate or line posts shall be driven and furnished with an approved anchor plate or other satisfactory device to hold the post in proper alignment and plumb. The plate or anchor shall be welded or riveted to the post with no less than two rivets.

Gate posts shall be set in concrete as shown on the plans.

Extra length posts shall be required at stream crossings as shown on the plans or as directed and also at ground depressions where it is not practicable for the fencing

603.05

80 to follow closely the contour of the ground. These posts shall be set in concrete as shown on the plans.

At small stream crossings and ground depressions, the space below the fence fabric shall be closed with barbed or ground tension wire, either on horizontal lines or fanned, as shown on the plans or as directed. The wires shall be stretched taut between and fastened to the posts to prevent vertical movement of the wires. Barbed or tension wire shall not be placed where its installation would cause collecting drifts in the channel.

603.05 Placing Barbed and Tension Wire and Fabric

90 The bottom of the fabric shall be placed above the ground line as shown on the plans. Over irregular ground, a minimum of 1 in. (25 mm) and a maximum of 4 in. (100 mm) clearance will be permitted. All necessary excavation and backfilling required shall be in accordance with 201.03.

The tension required to stretch the fabric and wire shall be applied by mechanical fence stretchers and with single wire stretchers designed and manufactured for the purpose, and in accordance with the fence manufacturer's recommendations.

100 All splices in the fabric and wire shall be securely made in accordance with the best practice and the manufacturer's recommendations, and by the use of tools designed for that purpose.

110 Farm field fence shall be placed by fastening one end and then applying sufficient tension to remove all slack before making permanent attachments elsewhere. The line wires shall be fastened to end, corner, and pull posts by wrapping the wires around the posts and tying the wire back on itself with no less than 1 1/2 tightly wrapped twists. Tying shall be with tools designed for the purpose in accordance with the fence manufacturer's recommendations. This same method shall be used in placing barbed or tension wire. Fence fabric shall be fastened to intermediate or line posts with at least five wire ties. Barbed or tension wire shall be fastened in the same manner with one fastening device for each post.

120 The top and bottom tension wires of chain link fence shall be placed, stretched taut, and secured at the ends and to all posts before the fabric is placed. The ends of the fabric shall be secured by the use of stretcher-bars threaded through the loops of the fabric and secured to the posts by means of clamps with bolts and nuts. The number of clamps shall be as indicated on the plans. The fabric shall be placed by securing one end and then applying tension to remove all slack before making attachments elsewhere. The fabric shall be fastened to the line posts and to the top and bottom tension wires with tie wires spaced as shown on the plans.

603.06 Resetting Fence

Resetting fence shall consist of the removal of existing fence within the specified limits and, if necessary, storing and then resetting it in accordance with the plans, or as directed. Resetting fence shall be in accordance with 603.03, 603.04, and 603.05. Damaged or missing parts, including posts shall be replaced.

603.07 Method of Measurement

- 130 Fence and resetting fence will be measured by the linear foot (meter) for the type specified. Measurement will be made along the top of the fence from outside to outside of end posts for each continuous run of fence.

Gates will be measured as complete units of the size and type specified.

603.08 Basis of Payment

- The accepted quantities of fence and resetting fence will be paid for at the contract unit price per linear foot (meter) for the type specified, complete in place. Gates will be paid for at the contract unit price per each for fence gate, of the type and size specified, complete in place.
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Payment will be made under:

	Pay Item	Pay Unit Symbol
	Fence, _____, _____ in. (mm)..... type height	LFT (m)
	Fence, _____, Reset..... type	LFT (m)
150	Fence, Farm Field, Barbed Wire, _____ in. (mm).....	LFT (m)
	Fence, Farm Field, Tension Wire, _____ in. (mm)	LFT (m)
	Fence Gate, _____, _____ in. (mm) x _____ft (m)	EACH
	type height length	

The cost of adding grounding in accordance with the National Electric Safety Code including all materials, and labor shall be included in the cost of the fence.

The cost of fence, and corner, end, line, and pull posts shall be included in the cost of the fence.

- 160 The cost of fence, post and miscellaneous hardware shall be in the cost of the gate.

The cost of all miscellaneous hardware related to the type of fence including brace connections, caps, clips, clamps, hinges, rivets, ties, truss rods, diagonal braces and stretcher bars shall be included in the cost of the fence.

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The cost of concrete for posts, braces or anchors shall be included in the cost of the fence and gates.

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The cost of removal, storage, re-installation, and the replacement of damaged or missing parts shall be included in the cost of the resetting fence.

SECTION 604 – SIDEWALKS, CURB RAMPS, STEPS, AND HANDRAILS

604.01 Description

This work shall consist of constructing HMA or PCC sidewalks; curb ramps; concrete steps; or the reconstruction of PCC sidewalks in accordance with 105.03.

MATERIALS

604.02 Materials

10 Materials shall be in accordance with the following:

Coarse Aggregate, Class D or Higher, Size No. 53	904
Concrete, Class A	702
Detectable Warning Elements	905.05
Fine Aggregate, Size No. 23, No. 24, or No. 15	904
Joint Filler	906.01
Paint.....	909.05
Reinforcing Bars.....	910.01
Silica Sand.....	ASTM C 778

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Hand railing shall be aluminum pipe in accordance with ASTM 221, alloy 6063, temper T52 or galvanized steel pipe in accordance with ASTM A 53, grade B, all as specified.

The detectable warning elements shall be set in a thin set latex modified mortar as recommended by the element manufacturer for outdoor use for adhering brick to concrete.

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A type A certification in accordance with 916 for thin set latex modified mortar shall be furnished prior to use of the materials.

A type C certification in accordance with 916 for the silica sand shall be furnished prior to use of the material.

CONSTRUCTION REQUIREMENTS

604.03 Portland Cement Concrete Sidewalks and Curb Ramps

(a) General Requirements

40 The location of curb ramps shall take precedence over the location of drainage structures and signal, utility, or light poles. Drainage structures shall not be located within the limits of the curb ramp, exclusive of flared sides. Poles shall be located so as not to impede the usage or safety of the curb ramps. Crosswalk markings shall be located such that the curb ramps shall be contained within the markings unless otherwise specified. The flared sides need not fall within the crosswalk lines. The normal gutter flow line shall be maintained throughout the curb ramp area, and appropriate drainage structures shall be used, as needed, to intercept the flow prior to the curb ramp area. Positive drainage shall also be provided to carry water away from the intersection of the curb ramp and the gutter line.

50

The bottom edge of curb ramps and the top of curb shall be flush with the edge of the adjacent pavement or the gutter line.

The curb ramp running slope shall not exceed 12:1, except where conditions necessitate, a 10:1 slope may be utilized for a maximum rise of 6 in. (150 mm). Curb ramp cross slope shall not exceed 50:1 except where infeasible.

(b) Excavation

60 Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the forms. The foundation shall be shaped and compacted to a firm even surface in accordance with the section shown on the plans. All soft and yielding material shall be removed and replaced with acceptable material.

(c) Forms

70 Forms shall be of wood, metal, or other approved material and shall extend for the full depth of the concrete. Forms shall be straight, free from warp, and of sufficient strength to resist the pressure of the concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.

(d) Placing Concrete

The foundation shall be thoroughly moistened immediately prior to the placing of the concrete. The proportioning, mixing, and placing of the concrete shall be in accordance with 702. The thickness of the concrete in the curb ramp, including flared sides, shall be as shown on the plans for the type specified.

(e) Finishing

80 The surface shall be finished with a wooden float. No plastering of the surface will be permitted. Ramp surfaces shall be coarse broomed and corrugated transverse

604.04

to the slope as shown on the plans. The surface texture of the flared sides shall be coarse broomed with the striations transverse to the slope.

All exposed edges shall be finished with a 1/4 in. (6 mm) radius.

(f) Joints

The type and location of joints and the size of preformed joint filler shall be as shown on the plans.

- 90 All concrete joints shall be finished with a 1/4 in. (6 mm) radius.

Preformed 1/2 in. (13 mm) joint filler shall be placed around all appurtenances, such as manholes and utility poles which extend into and through the sidewalk, and between the sidewalk and any fixed structure, such as a building or bridge. The preformed joint filler shall extend for the full depth of the sidewalk or curb ramp, and shall be flush with the surface of the adjacent concrete.

(g) Detectable Warning Elements

- 100 Detectable warning elements shall be as shown on the plans. They shall be set in a thin set mortar on top of the concrete base. The concrete base shall be cleaned of all materials which might prevent the mortar from adhering to the base. The mortar shall be applied to the concrete in accordance with the manufacturer's recommendations. Where elements smaller than full sized are needed, whole elements shall be cut full depth with an appropriate power saw.

Brick joints shall be hand tight with a maximum of 1/16 in. (1.5 mm) width.

- 110 The joints between bricks shall be filled with a fine aggregate No. 15 or an equivalent sand. This filling shall be accomplished by repeated brooming of the aggregate across the face of the bricks. Excess aggregate shall then be removed from the surface.

(h) Curing

Concrete shall be cured for at least 72 h. Curing shall be in accordance with 504.04 except curing compound shall not be used in the area where detectable warning elements are to be installed. During the curing period all pedestrian traffic shall be excluded.

(i) Painting

- 120 The exposed surfaces of the curb throughout the width of curb ramps shall be painted yellow in accordance with 808.06. Silica sand shall be applied to the wet paint along the top of the curb at the rate of 6.0 lb/gal. (0.7 kg/L).

604.04 PCC Steps

PCC steps shall be in accordance with the applicable provisions of 604.03. In addition, all exposed edges shall be rounded to a 1/4 in. (6 mm) radius.

604.05 Reconstructed PCC Sidewalk

Where existing concrete sidewalk is to be reconstructed, all disintegrated concrete, brick, stone, or other material shall be completely removed and replaced with new concrete sidewalk in accordance with 604.03.

Such sidewalk shall be constructed to a minimum depth of 4 in. (100 mm) unless another depth is designated and to the width of the adjoining walk, or to a width of no less than 48 in. (1200 mm) from the face of curb, or to such other width as directed.

The removal of concrete sidewalk shall be to uniform lines as directed. The sidewalk to be removed shall be cut in a straight line with an approved power driven concrete saw. The sawing shall be such that the portion of sidewalk to remain in place shall not be damaged. All portions which are damaged or removed back of the established line shall be replaced.

Unless otherwise directed, sidewalk which must be removed shall be removed between tool marks or joints. At locations where the sidewalk and curb are adjacent and the curb is deteriorated, the curb shall also be replaced as directed.

The new sidewalk shall have a joint pattern similar to the surrounding sidewalk. Sidewalk placed at drives shall be 6 in. (150 mm) thick, or the same depth of the existing drive, whichever is greater.

604.06 Re-Laid Sidewalk

This work consists of the removal and re-laying of concrete, stone-slab, or brick sidewalk at the locations shown on the plans or as directed. In the operations of removing and re-laying, care shall be taken not to damage any of the sidewalk. Before re-laying, a cushion of fine aggregate shall be spread on the prepared subgrade to a depth of no less than 2 in. (50 mm). Cracked or damaged sections shall not be re-laid but shall be disposed of as directed.

604.07 HMA Sidewalk

(a) Excavation and Forms

Excavation and forms, when required, shall be in accordance with 604.03(b) and 604.03(c).

(b) Bed Course

Bed course material shall be coarse aggregate No. 53 and shall be placed in lifts not exceeding 4 in. (100 mm) in depth. Each lift shall be thoroughly compacted.

(c) Placing HMA Sidewalk

HMA sidewalk material shall be placed on a compacted bed course in one or more courses. The mixture shall consist of HMA base, intermediate, or surface, type

604.08

A in accordance with 402. A MAF in accordance with 402.05 will not apply. Aggregate requirements of 904.03(d) do not apply. Compaction shall be accomplished by means of a hand operated or power roller of an acceptable type and weight (mass) in accordance with 402.15. In areas inaccessible to the roller, hand tamping will be permitted. In any case, the HMA sidewalk material shall be uniformly compacted.

- 180 If the finished compacted surface is too open or remains sticky, the surface shall be given a coating of fine aggregate, well broomed over the surface, leaving no excess.

604.08 Backfilling and Finishing Shoulders and Slopes

After forms have been removed, the space on each side of the sidewalks shall be filled to the required elevation with suitable material which shall be firmly compacted and neatly graded. Adjacent shoulders and slopes shall be finished to the required grade and cross section.

190 604.09 Hand Rails

This railing shall be erected in a workmanlike manner, straight and true to grade. Posts shall be vertical and railings shall be parallel to the walk surface or the plane of the steps and spaced as shown on the plans. Fastenings shall be as indicated on the plans. Railing posts on masonry shall be held in place in a manner that develops the full strength of the railing post in bending.

- 200 Fabrication and placement of railings shall be completed in accordance with the applicable requirements of 711. Ends of tube sections shall be milled or sawed. Cut ends shall be true, smooth, and free from burrs and ragged edges. Welds shall be ground smooth. The rail system shall be continuous except as shown on the plans. Joints shall be spliced as detailed on the plans. Welding of steel shall be in accordance with 711.32 and welding of aluminum shall be in accordance with the applicable requirements of 803. Radiographic, magnetic particle, and dye penetrant inspection will not be required.

All aluminum surfaces in contact with concrete shall be coated with an aluminum impregnated caulking compound prior to installation. After installation and alignment, openings between metal surfaces and concrete shall be sealed in a watertight manner with the caulking compound.

210

Steel pipe railing not designated to be painted shall be galvanized after fabrication and prior to installation. Railing designated to be painted shall receive one shop coat of paint after fabrication and two field coats after installation. The type and color of paint shall be as specified on the plans. Cleaning and painting shall be in accordance with 619.

604.10 Method of Measurement

Concrete sidewalk, reconstructed concrete sidewalk, and re-laid concrete sidewalk will be measured by the square yard (square meter) of finished surface.
 220 HMA for sidewalk will be measured by the ton (megagram) of mixture placed. Bed course material will be measured by the ton (megagram).

Concrete curb ramps will be measured by the square yard (square meter) in accordance with the pay limits shown on the plans.

Concrete steps will be measured by the cubic yard (cubic meter) based on the neat lines shown on the plans.

Hand rails will be measured by the linear foot (meter) in accordance with the dimensions shown on the plans or as directed. Measurements will be made from end to end of the railing along the centerline.
 230

Curb and curb and gutter will be measured in accordance with 605.09. Reinforcing bars, if used, will be measured in accordance with 703.07.

604.11 Basis of Payment

The accepted quantities of concrete sidewalk will be paid for at the contract unit price per square yard (square meter) for sidewalk, concrete. HMA for sidewalk will be paid for at the contract unit price per ton (megagram), complete in place. Bed
 240 course material will be paid for at the contract unit price per ton (megagram). Concrete steps will be paid for at the contract unit price per cubic yard (cubic meter) for steps, concrete. Reconstructed sidewalk and re-laid sidewalk will be paid for at the contract unit price per square yard (square meter) for sidewalk, reconstruct, or sidewalk, re-lay. Joint material will be paid for at the contract unit price per linear foot (meter), complete in place.

The accepted quantities of curb ramps will be paid for at the contract unit price per square yard (square meter) for curb ramp, concrete, per the type, complete in place.
 250

Hand rails will be paid for at the contract unit price per linear foot (meter).

Curb and curb and gutter will be paid for in accordance with 605.10.

Reinforcing bars, if used, will be paid for in accordance with 703.08. Curb, if directed to be replaced, will be paid for in accordance with 605.10.

Payment will be made under:

260	Pay Item	Pay Unit Symbol
	Bed Course Material.....	TON (Mg)

605.01

	Curb Ramp, Concrete, _____	SYS (m2)
	type	
	Hand Rail, _____	LFT (m)
	type	
	HMA for Sidewalk	TON (Mg)
	Joint Material LFT (m)	
270	Sidewalk, Concrete.....	SYS (m2)
	Sidewalk, Concrete, Reconstruct.....	SYS (m2)
	Sidewalk, Concrete, Re-Lay	SYS (m2)
	Steps, Concrete.....	CYS (m3)

The cost of excavation, backfill, and necessary incidentals shall be included in the cost of the pay items in this section.

280 The removal and disposal of concrete sidewalk which is unsuitable for re-laying and which has not been damaged due to negligence will be paid for in accordance with 202.13. Concrete sidewalk which is specified to be re-laid or to remain in place and which is damaged shall be removed and disposed of and replaced with no additional payment.

If directed, concrete sidewalk shall be constructed to a depth greater than that shown on the plans. Such additional thickness will be converted into the equivalent square yards (square meters) quantity of concrete sidewalk of the thickness shown on the plans and will be paid for as such.

290 The cost of furnishing and applying sand to finished compacted surfaces shall be included in the cost of HMA for sidewalk.

The cost of the concrete base, detectable warning element, thin set mortar, fine aggregate for filling joints, and the painting of curb through the width of the curb ramp including the silica sand shall be included in the cost of the curb ramp.

The cost of aluminum impregnated caulking compound and the painting of steel hand railing shall be included in the cost of the hand rail.

SECTION 605 – CURBING

605.01 Description

This work shall consist of the construction of curb or curb turnouts; combination curb and gutter, combined curb and gutter turnouts; or resetting curb in accordance with 105.03.

MATERIALS

10 605.02 Materials

Materials shall be in accordance with the following:

Coarse Aggregate, Class D or Higher, Size No. 53	904
Concrete	502
Joint Materials	906
Joint Mortar	906.03
Precast Concrete Curbing	904.04(e)
Reinforcing Steel	910.01

20 **605.03 Precast Cement Concrete Curbing**

(a) Excavation

Excavation shall be made to the required depth and the base upon which the curb is to be set shall be compacted to a firm even surface. All soft and unsuitable material shall be removed and replaced with suitable material which shall be thoroughly compacted.

(b) Installation

30 The curb shall be set in accordance with the line and grade required. The face and top of the curb shall be checked with a 10 ft (3 m) straightedge. Portions showing irregularities of 0.25 in. (6 mm) or more shall be removed and replaced with no additional payment. All spaces under the curbing shall be filled with bed course material. The bed course material shall be coarse aggregate No. 53 and shall be thoroughly tamped.

(c) Joints

40 Curbing shall be laid with joints as indicated on the plans. These joints shall be filled with mortar as specified. Where a portland cement concrete pavement is to be constructed contiguous to a curbing, joints shall be constructed in the curbing directly in line with pavement expansion joints. The joint in the curbing shall be the same width as the pavement joint and shall be filled with an expansion joint filler of the nominal thickness as the pavement joint. Any voids between the joint filler and the curb shall be filled with mortar.

(d) Backfilling

After the curb has set, any remaining excavated areas shall be filled with approved material. This material shall be placed and thoroughly tamped in layers not exceeding 6 in. (150 mm) in depth.

50 **605.04 Cast in Place Cement Concrete Curbing**

(a) Excavation

Excavation and bedding shall be in accordance with 605.03(a).

(b) Forms

Forms shall be of wood or metal, straight, free from warp, and of such construction that there will be no interference to the inspection of grade or

alignment. All forms shall extend for the entire depth of the curb and shall be braced and secured sufficiently so that no deflection from alignment or grade shall occur during the placing of the concrete.

(c) Proportioning and Placing

Concrete shall be proportioned, mixed, and placed in accordance with 502, except utilization of the Department provided spreadsheet is not required for the CMDS. Where integral curb and gutter is specified, that portion of the curb below the upper surface elevation of the adjoining pavement shall be constructed by extending the pavement to the outer vertical plane of the curb at the time the pavement is placed. The concrete used in this extension shall be the same composition as that of the pavement.

70

As an option, an integral curb and gutter may be placed at the same time as the PCCP pavement by the slip form method. The slip form machine must have an attachment to place, consolidate and shape the concrete to the required shape and dimensions. The reinforcement tie bars or stirrups between the pavement and the curb shall be omitted.

After the concrete for the upper portion is placed in the forms, it shall be tamped and spaded or vibrated until mortar entirely covers the surface. The top shall be floated smooth and the outer upper corner rounded to a 0.25 in. (6 mm) radius.

80

The face and top of the curb, integral curb, and gutter shall be checked with a 10 ft (3 m) straightedge. Portions showing irregularities of 0.25 in. (6 mm) or more shall be removed and replaced.

90

Consolidation of concrete placed in the forms shall be by vibration or other acceptable methods. Forms shall be left in place for 24 h or until the concrete has set sufficiently so that they can be removed without injury to the curbing. Upon removal of the forms, the exposed curbing face shall be rubbed immediately to a uniform surface. Rubbing shall be accomplished by the use of water and a carborundum brick. For the purpose of matching adjacent concrete finishes or for other reasons, other methods of finishing may be permitted. No plastering will be permitted.

(d) Curb Turnouts and Combined Concrete Curb and Gutter Turnouts

Turnouts will be required with specified inlets or with concrete gutter and paved side ditch in accordance with 607 and as shown on the plans. Concrete gutter and paved side ditch shall be constructed monolithically with the curb turnout.

(e) Joints

Joints in integral curbs shall be located at joints in adjoining PCCP. The joints shall be saw cut or formed with 0.25 in. (6 mm) thick preformed joint material. Joint sealant is not required for joints in integral curbs.

100

Curbing not constructed integral with adjacent pavement shall be constructed with intermediate joints located at 10 ft (3 m) intervals. These joints may be sawed or formed with metal separator plates, and the depth and width shall be in accordance with the plans.

Preformed expansion joints, 0.25 in. (6 mm) thick, shall be placed at the beginning and end of all curb returns and also at castings.

110

(f) Curing

Immediately upon completion of the rubbing, the curbing shall be moistened and kept moist for three days, or cured by the use of membrane forming material. The method and details of curing shall be subject to approval.

(g) Backfilling

After the concrete has set sufficiently, the spaces in front and back of the curb shall be refilled with suitable material to the required elevations in layers of not more than 6 in. (150 mm) and be tamped thoroughly.

120

(h) Curb Machine

Curb machines may be used to construct curb provided the curb can be constructed to the requirements of the specifications.

605.05 Reflecting Cement Concrete Curbing

Construction methods for this item shall be in accordance with 605.03 and the following requirements.

The reflecting surface of the curbing shall be a mortar mix consisting of one part white portland cement to 1 3/4 parts of light colored, washed, mortar sand. This mortar mix shall have a thickness of approximately 1 in. (25 mm). Alternately, the entire curbing may be constructed of concrete made with white portland cement.

130

Washed mortar sand shall meet all the requirements for mortar sand and shall be of a light satisfactory color. The reflecting surface mortar shall be placed immediately after the placing of the base concrete. No more than 20 min shall elapse between the placing of the base concrete and the placing of the reflecting surface.

Scoring or surface deformation and finish of the reflecting surface shall be in accordance with the details shown on the plans.

140

605.06 Concrete Center Curbing

The subgrade shall be prepared the same as for the adjoining pavement. If subbase is provided for the adjoining pavement, it shall be carried through for the full width of the curb and at the same thickness as that for the pavement.

605.07

The temperature limitations of 502.11 shall apply to placing the concrete. The surface shall be troweled smooth with a metal trowel. Curing shall be in accordance with 504.04.

150

Forms shall be removed within 24 h after the concrete has been placed. Plane surfaces and exposed sides of the curb shall be checked with a 10 ft (3 m) straightedge. Portions showing irregularities of 0.25 in. (6 mm) or more shall be removed and replaced in compliance with these specifications.

Joints in center curbs adjacent to PCCP shall be aligned with joints in adjoining PCCP. Joints in center curbs adjacent to asphalt shall be spaced at 18 ft (15.5 m) maximum. The joints shall be saw cut or formed with 0.25 in. (6 mm) thick preformed joint material. Joint sealant is not required for joints in center curbs.

160

Where an expansion joint is constructed in PCCP adjacent to concrete center curb, the expansion joint shall be carried through the center curb in accordance with applicable requirements of 503.03(f).

605.07 HMA Curbing

(a) Excavation

Excavation shall be in accordance with 605.03(a).

170

(b) Preparation of Bed

When curbing is to be constructed on a fresh laid HMA surface, the curb may be laid only after the surface has been cleaned.

When curbing is to be constructed on a cured or aged portland cement concrete base, asphalt pavement, or asphalt treated base, the bed shall be thoroughly swept and cleaned with compressed air. The surface shall be thoroughly dried and, immediately prior to placing of the HMA mixture, shall receive a tack coat in accordance with 406. During application, the spread of this tack coat to areas outside of the area to be occupied by the curb shall be prevented.

180

(c) Mixture

The mixture shall be in accordance with 402.07(d).

Acceptance of HMA curbing mixtures will be a type D Certification in accordance with 916. The test results shown on the certification shall be the quality control tests representing the material supplied and include gradation and binder content. The gradation tolerances shall be $\pm 2.5\%$ on the No. 200 (75 μm) sieve, $\pm 4.0\%$ on the No. 4 (4.75 mm) sieve, and binder content tolerance shall be $\pm 0.5\%$ from DMF.

190

(d) Placing

HMA curbing shall be constructed by use of a self-propelled automatic curber, curb machine or paver with curbing attachments. The curbing shall be in accordance with the section shown on the plans. The automatic curber or machine shall meet the following requirements and shall be approved prior to use.

1. The weight of the machine shall be such that required compaction is obtained without the machine riding above the bed on which curbing is being constructed.
2. The machine shall form curbing that is uniform in texture, shape, and density.

200

The construction of curbing by means other than the automatic curber or machine may be permitted when short sections or sections with short radii are required, or for such other reasons as may seem warranted. The resulting curbing shall conform in all respects to the curbing produced by the use of the machine. The face and top of the HMA curb shall be checked with a 10 ft (3 m) straightedge. Portions showing irregularities of 0.25 in. (6 mm) or more shall be removed and replaced.

210

Weather limitations shall be in accordance with 402.12.

(e) Painting and Sealing

When sealing or painting is required, it shall be performed only on a curbing which is clean and dry and which has reached the ambient temperature.

605.08 Resetting Curbing

220

(a) Salvage of Curbing

Curbing specified for resetting shall be cleaned, removed, and stored. Any existing curbing that is to be reset which is lost, damaged, or destroyed as a result of operations or because of failure to store and protect it in a manner that would eliminate its loss or damage, shall be replaced.

(b) Curb Removal

Curbing, which is unsuitable for resetting and which has not been damaged due to negligence, shall be removed and disposed of as directed.

230

(c) Excavation

Excavation and bedding shall be in accordance with 605.03(a).

(d) Resetting

The curb shall be set on a firm bed in accordance with the required line and grade. All sections of curbing shall be set so that the maximum opening between adjacent sections is 0.75 in. (20 mm) wide for the entire exposed top and face. Any

605.09

240 dressing of the ends of the curbing necessary to meet this requirement shall be done as needed. Cutting or fitting may be necessary in order to install the curbing at the locations as directed.

After the curb has been set, the joints shall be completely filled with mortar as specified.

(e) Backfilling

The spaces in front and back of the curb shall be refilled to the required elevation with suitable material. This material shall be tamped thoroughly in layers of not over 6 in. (150 mm) in depth.

605.09 Method of Measurement

250 Curbing, both new and reset, and curb removal will be measured by the linear foot (meter) along the front face of the section at the finished grade elevation. Combined curb and gutter will be measured along the face of the curb. Curb turnout will be measured longitudinally by the linear foot (meter) as curb of the type specified, from the ends of the radii which touch the front face of the longitudinal curb portion. Combined curb and gutter turnout will be measured longitudinally by the linear foot (meter) as curb and gutter of the type specified, from the ends of the radii which touch the front face of the longitudinal curb portion. No deduction in length will be made for drainage structures installed in the curbing such as catch basins or drop inlets. Concrete center curb will be measured by the linear foot
260 (meter), unless it is of variable width, in which case measurement will be by the square yard (square meter).

Bed course material will be measured by the ton (megagram).

605.10 Basis of Payment

The accepted quantities of curb work will be paid for at the contract unit price per linear foot (meter) for curb; curb and gutter; curb, reset; or center curb, of the type specified. Variable width center curb will be paid for at the contract unit price per square yard (square meter) for center curb, of the width specified. Bed course
270 material will be paid for at the contract unit price per ton (megagram), complete in place.

Curb turnout will be paid for at the contract unit price per linear foot (meter) of the type of curb specified. Combined curb and gutter will be paid for at the contract unit price per linear foot (meter) for curb and gutter of the type specified.

Payment will be made under:

280	Pay Item	Pay Unit Symbol
	Bed Course Material.....	TON (Mg)

	Center Curb, _____	LFT (m)
	type	
	Center Curb, _____ ft (m)	SYS (m2)
	type	
	Curb, _____	LFT (m)
	type	
	Curb and Gutter, _____	LFT (m)
	type	
290	Curb, Remove.....	LFT (m)
	Curb, Reset, _____	LFT (m)
	type	

The cost of tack coat, reinforcing steel or mesh reinforcement for curb, curb and gutter, or center curb shall be included in the cost of the pay items. The cost of replacement curb portions for those which show irregularities or 0.25 in. (6 mm) or more shall be included in the cost of curb.

SECTION 606 – SHOULDER CORRUGATIONS

606.01 Description

This work shall consist of placing corrugations in paved shoulders in accordance with 105.03. Corrugations shall not be constructed within the limits of reinforced concrete bridge approaches or on bridge decks.

The operation shall be coordinated such that milled materials do not encroach on pavement lanes carrying traffic and all milled materials are disposed of in
10 accordance with 104.07.

The corrugations shall be constructed by cutting smooth strips in existing or newly constructed shoulders. The operation shall be conducted by means of a cutting machine that provides a series of smooth cuts without tearing or snagging. The equipment shall include guides to maintain uniformity and consistency in the alignment of the strips.

606.02 Method of Measurement

HMA and PCCP shoulder corrugations will be measured by the linear foot
20 (meter), measured parallel to the center line of the roadway. Gaps in PCCP shoulder corrugations at the D-1 joints will be included as milled PCCP corrugations.

606.03 Basis of Payment

HMA and PCCP shoulder corrugations will be paid for at the contact unit price per linear foot (meter), when specified.

Payment will be made under:

607.01

	Pay Item	Pay Unit Symbol
30	Milled HMA Shoulder Corrugations.....	LFT (m)
	Miller PCCP Shoulder Corrugations	LFT (m)

SECTION 607 – PAVED SIDE DITCH OR CONCRETE GUTTER

607.01 Description

This work shall consist of placing a portland cement concrete lining, gutter, or reinforced concrete gutter turnout for side ditches in accordance with 105.03.

MATERIALS

607.02 Materials

10 Materials shall be in accordance with the following:

Concrete, Class A	702
Reinforcing Steel	910.01

CONSTRUCTION REQUIREMENTS

607.03 General Requirements

20 The excavation shall be to the required depth and shape of the bottom of the type and size of the side ditch being constructed, the details of which are shown on the plans. All soft, yielding, or unsuitable materials encountered at the required excavation elevation shall be removed and replaced with approved materials which shall be compacted and finished to a firm, smooth surface.

The applicable requirements of 605.04(b) shall apply to forms.

Placing, finishing, and curing shall be in accordance with 605.04 except the curing period shall be no less than 72 h. The finished surface need not be brushed.

30 Reinforcement will be required for all paved side ditch, cut-off-walls, and lugs as shown on the plans.

Paved side ditch transitions will be required at intersections with earth ditches and pipe culverts.

Transitions of 10 ft (3 m) or less will be required between two different types of paved side ditches.

40 Cut-off wall and lug details shall be as shown on the plans. A cut-off wall shall be constructed at the beginning and end of any paved side ditch. Lugs shall be poured monolithic with paved side ditch on steep grades. Their locations shall be as

shown on the plans or as otherwise directed. Backfilling shall be in accordance with 605.04(g).

607.04 Cement Concrete Gutter and Turnout

Concrete gutter and concrete gutter turnout shall be constructed as shown on the plans or where directed. Construction shall be in accordance with all applicable requirements set out herein for paved side ditch.

607.05 Method of Measurement

- 50 Paved side ditch or cement concrete gutter will be measured by the linear foot (meter) along the centerline of the ditch per each type specified. Each cutoff wall or lug will be measured as 8 lft (2.5 m) of paved side ditch or cement concrete gutter. Paved side ditch transitions at earth ditches and pipe culverts will be measured as equivalent lengths in linear feet (meters) of the paved side ditch specified at each location. Transitions at the intersection of two different types of paved side ditch will be converted to equivalent lengths in linear feet (meters) of the larger type of paved side ditch specified at each site.

- 60 Reinforced concrete gutter turnout will be measured as 50 lft (15 m) of concrete gutter. Additional length, if required, will be measured by the linear foot (meter) of concrete gutter.

607.06 Basis of Payment

The accepted quantities of paved side ditch or cement concrete gutter of the type specified, including cutoff walls and lugs measured in accordance with 607.05, will be paid for at the contract unit price per linear foot (meter) complete in place. Concrete gutter turnout will be paid for at the contract unit price per linear foot (meter) for gutter, concrete, of the type specified.

- 70 Payment will be made under:

Pay Item	Pay Unit Symbol
Gutter, Concrete, _____ type	LFT (m)
Paved Side Ditch, _____ type	LFT (m)

- 80 The cost of reinforcing steel or mesh, excavation, joints, and necessary incidentals shall be included in the cost of the pay items.

SECTION 608 – SHOULDER DRAINS

608.01 Description

This work shall consist of constructing shoulder drains in accordance with these specifications and in accordance with 105.03.

MATERIALS

608.02 Materials

10 Materials shall be in accordance with the following:

Coarse Aggregates, Class D or Higher, Size No. 8 904

CONSTRUCTION REQUIREMENTS

608.03 General Requirements

Unless otherwise designated, shoulder drains shall be installed on both sides of the pavement by trenching from the edges of the pavement through the shoulders and backfilling with aggregate at low points in the grade and at other locations when so
20 directed. This work shall precede the finishing of the shoulders.

The width of the trench shall be approximately 12 in. (300 mm) unless otherwise directed. Other dimensions shall be as shown on the plans.

After the trench has been prepared, it shall be backfilled to the required elevation with aggregate, and then be well compacted. After this, any remaining unfilled trench area shall be filled with material approved for shoulders and compacted by rolling or tamping or both. The finished shoulder elevation shall conform with that required at that point.

30

608.04 Method of Measurement

Shoulder drains will be measured by the ton (megagram) of aggregate placed.

608.05 Basis of Payment

The accepted quantities of aggregate for shoulder drains will be paid for at the contract unit price per ton (megagram) for aggregate for shoulder drains complete in place.

Payment will be made under:

40

Pay Item

Pay Unit Symbol

Aggregate for Shoulder Drains TON (Mg)

Excavation, trenching, backfilling, and other related miscellaneous items will not be paid for separately, but the cost thereof shall be included in the cost of the pay item.

SECTION 609 – REINFORCED CONCRETE BRIDGE APPROACHES

609.01 Description

This work shall consist of constructing reinforced concrete bridge approaches, RCBA, on a prepared subgrade and subbase in accordance with 105.03.

MATERIALS

609.02 Materials

10 Materials shall be in accordance with the following:

Coarse Aggregate, Class D or Higher, Size No. 53	904
Concrete, Class C*	702
Curing Materials.....	912.01
Joint Materials	906.02(a)1
Reinforcing Bars, Epoxy Coated	910.01
Support Devices	910.01(b)9

*Coarse Aggregate shall be Class AP, Size No. 8

20

CONSTRUCTION REQUIREMENTS

609.03 General Requirements

Subgrade shall be prepared in accordance with 207. Subbase shall be prepared in accordance with 302.

609.04 Forms

Forms shall be either steel or wood and shall be in accordance with 508.04(c)1 or 508.04(c)2.

30

609.05 Joints

Longitudinal construction joints will only be permitted as shown on the plans. The type I-A joint shall be constructed as shown on the plans.

Type I-A joints shall be created by sawing slots using sawing equipment in accordance with 508.07. The joint shall be cut in two operations. The initial saw cut shall commence as soon as the concrete has hardened sufficiently to permit sawing without raveling, usually 2 to 12 h after placement.

40 The second saw cut shall be made after the concrete has sufficiently cured, but before opening the RCBA to all traffic. Slurry or saw residue remaining in the slot shall be immediately flushed. Construction traffic shall not be allowed on the RCBA after the second saw cut until the joint is sealed.

The sawed slot shall be cleaned to remove all foreign matter from the entire depth of cut. Joint sealing shall be in accordance with 503.05.

609.06

609.06 Reinforcing Bars

Furnishing and placement of reinforcing bars shall be in accordance with 703.

50 **609.07 Thickness**

The depth of the RCBA will be checked by the Engineer prior to pouring, by making stringline measurements every 3 ft (1 m) across the width of the approach. Any location deficient in depth by 1/2 in. (13 mm) or more shall be corrected prior to placing the concrete.

609.08 Concrete Placement

The subbase shall be uniformly moist at the time of concrete placement. Delivery and placement of concrete shall be in accordance with 702.

60 **609.09 Finishing**

The RCBA shall be finished with equipment in accordance with 508.04(c)3 and 508.04(c)4. The operations shall be controlled so that an excess of mortar and water is not worked to the top. Long handled floats may be used to smooth and fill in open textured areas. The edges of formed RCBA shall be tooled or chamfered.

70 The finished RCBA surface shall be textured with a double thickness burlap drag or a minimum 4 ft (1.2 m) wide turf drag. Immediately after the finishing operation is complete and before the surface film has formed, the surface of the RCBA shall be textured by transverse grooving in accordance with 504.03. The grooves may be formed by mechanized equipment using a vibrating beam roller, a series of discs or other approved device. Manual tools such as fluted floats, spring steel tined rakes, or finned floats with a single row of fins may be used. The grooves shall be relatively uniform and smooth and shall be formed without tearing the surface or bringing coarse aggregate to the top.

80 All areas of hardened RCBA which do not conform to the requirements due to either a deficiency in the grooving or a rough open textured surface shall be corrected. Corrections shall be made by cutting transverse grooves in the hardened surface with an approved cutting machine and retexturing to a satisfactory finish as directed.

609.10 Curing

RCBA shall be wet cured in accordance with 702 or shall have liquid membrane forming curing compound applied to exposed surfaces within 30 min after the finishing operations have been completed. The edges of the RCBA shall be cured immediately upon removal of the forms. The edge shall be covered with curing materials equal to the material used on the surface or banked with soil 12 in. (300 mm) wide or greater.

90 When conditions arise which prevent timely application of curing materials the surfaces shall be kept wet with a fine spray of water. The fine spray of water shall continue until application of curing materials is resumed.

Liquid membrane forming curing compound shall be applied in a continuous uniform film at a rate not less than 1 gal./150 ft² (1 L/3.7 m²). Additional applications, if needed, shall follow the previous application within 30 min. The curing compound may be warmed in a water bath during cold weather at a temperature not exceeding 100°F (38°C). Thinning with solvents will not be permitted. Non-uniform film rates will result in the discontinuance of that application method.

A new coat of curing compound shall be applied to areas damaged by rain or other means during the curing period. The recoating shall be applied as soon as possible and at a rate equal to that specified for the original coat.

609.11 Smoothness

The smoothness of the surface of the RCBA will be measured by means of a 10 ft (3 m) long straightedge as soon as practical following curing or completion of adjoining roadway or structure sections. All surface variations shall be corrected to 1/8 in. (3 mm) or less.

Smoothness variations outside specified tolerances shall be corrected in accordance with 502.20.

609.12 Opening to Traffic

RCBA may be opened to traffic after 14 days. The RCBA may be opened earlier if test beams indicate a modulus of rupture of 550 psi (3800 kPa) or greater.

The Contractor and Engineer will conduct an inspection of the new RCBA for any damage. The inspection and all necessary repairs shall be completed prior to opening to traffic.

609.13 Method of Measurement

Reinforced concrete bridge approaches will be measured by the square yard (square meter). Dense graded subbase will be measured in accordance with 302.08. Reinforcing bars will be measured in accordance with 703.07.

Subgrade preparation will not be measured for payment. Finishing and curing of the RCBA will not be measured for payment. Construction joints or type I-A joints will not be measured.

609.14 Basis of Payment

Reinforced concrete bridge approaches will be paid for at the contract unit price per square yard (square meter). Dense graded subbase will be paid for in accordance with 302.09. Reinforcing bars will be paid for in accordance with 703.08.

Payment will be made under:

610.01

	Pay Item	Pay Unit Symbol
140	Reinforced Concrete Bridge Approach, _____ in. (mm).....SYS (m2) thickness	

The cost of all materials, water, equipment, and all labor for the compaction of the subgrade, shall be included in the cost of the RCBA.

The cost of finishing, furnishing and placing curing materials shall be included in the cost of the RCBA.

- 150 The cost of corrections for smoothness or re-texturing shall be included in the cost of the RCBA.

The cost of all labor and materials for the placement of construction joints and type I-A joints shall be included in the cost of the RCBA.

SECTION 610 – APPROACHES AND CROSSOVERS

610.01 Description

This work shall consist of constructing or resurfacing public road intersections; turn lanes, passing lanes, acceleration lanes, deceleration lanes, or recovery lanes where the total longitudinal dimension is less than 100 lft (30 m), excluding tapers; mail box approaches; private and commercial driveways; and crossovers; in accordance with 105.03.

10 MATERIALS

610.02 Materials

Materials shall be in accordance with the following:

Aggregate Base.....	301.02
Subbase.....	302.02
HMA.....	402.02
PCCP	502.02

20 CONSTRUCTION REQUIREMENTS

610.03 General Requirements

Subgrade for approaches shall be prepared in accordance with 207. Aggregate base shall be constructed in accordance with 301. HMA for approaches shall be constructed in accordance with 402. HMA mixture for approaches shall be HMA surface or intermediate, type A, B, C, or D in accordance with 402.04. A MAF in accordance with 402.04 will not apply.

- 30 Dense graded subbase shall be constructed in accordance with 302. PCCP for approaches shall be constructed in accordance with 502. The CMDS shall be submitted to the Engineer for approval. Utilization of the Department provided spreadsheet is not required.

610.04 Existing Approaches and Crossovers

If an existing surface is to be left in place as an approach pavement or crossover, the surface shall be patched in accordance with 304.04 or 305.04, or as directed. Existing approaches or crossovers that have been rubblized shall be primed in accordance with 405 prior to being paved.

610.05 Method of Measurement

40 Compacted aggregate base will be measured by the ton (megagram) in accordance with 109.01(b). HMA mixture for approaches will be measured by the ton (megagram) of the type specified, in accordance with 109.01(b). Dense graded subbase will be measured in accordance with 302.08. PCCP for approaches will be measured by the square yard (square meter) of the thickness specified. Subgrade treatment will be measured in accordance with 207.05.

- HMA patching in accordance with 610.04, will be measured by the ton (megagram) in accordance with 304.06. PCCP patching in accordance with 610.04, will be measured by the square yard (square meter) in accordance with 305.06.

Prime coat will be measured in accordance with 405.09. Tack coat will be measured in accordance with 406.06. Seal coat will be measured in accordance with 404.09.

610.06 Basis of Payment

- 60 The accepted quantities of HMA mixture for approaches will be paid for at the contract unit price per ton (megagram) of the type specified, complete in place. Compacted aggregate base will be paid for in accordance with 301.10. PCCP for approaches will be paid for at the contract unit price per square yard (square meter) of the thickness specified, complete in place. Dense graded subbase will be paid for in accordance with 302.09. Subgrade treatment will be paid for in accordance with 207.06.

HMA patching will be paid for in accordance with 304.07. PCCP patching will be paid for in accordance with 305.07.

Prime coat will be paid for in accordance with 405.10. Tack coat will be paid for in accordance with 406.07. Seal coat will be paid for in accordance with 404.10.

- 70 The quantities of materials placed on the 3 ft (1 m) wedge on approaches, when placed with the mainline pavement shall be included in the mainline HMA items and paid for in accordance with 401.22 or 402.20. The quantities, when placed separately

611.01

from the mainline pavement, shall be included in the quantities for HMA for approaches and paid for in accordance with 610.06.

80 The quantities of materials for the paving or resurfacing of turn lanes, passing lanes, acceleration lanes, deceleration lanes, and recovery lanes greater than 100 lft (30 m), excluding tapers, shall be included in the mainline quantities and paid for in accordance with 401.22, 402.20, 501.31, or 502.23 whichever is applicable.

The accepted quantities of HMA material for mailbox approaches will be included with quantities required to construct the shoulder section when the shoulder is to be paved. If the shoulder is not to be paved, the HMA material for mailbox approaches will be paid for as HMA mixture for approaches of the type specified.

Payment will be made under:

	Pay Item	Pay Unit Symbol
90	HMA for Approaches, Type ____*	TON (Mg)
	PCCP for Approaches, _____	SYS (m2)
	thickness	
	* Mixture type in accordance with 402.04.	

The cost of excavation, shaping, leveling, forming, compaction, placing, and all necessary incidentals shall be included in the cost of the pay items in this section.

100 The cost for curbing placed monolithically with the PCCP on approaches shall be included in the cost of PCCP for approaches.

SECTION 611 – MAILBOX INSTALLATIONS

611.01 Description

This work shall consist of the construction of mailbox installations in accordance with 105.03.

MATERIALS

611.02 Materials

10 Materials shall be in accordance with the following:

Mailbox Support Galvanized Hardware ASTM A 153
Nominal Standard Galvanized Pipe..... ASTM A 53
Treated Wood Posts..... 911.02(e)

CONSTRUCTION REQUIREMENTS

611.03 Mailbox Assembly

Existing mailboxes and assemblies shall be removed without damage from the highway right-of-way. Mailboxes, which must remain in service between removal and erection of the new assembly, shall be securely mounted to an empty 55 gal. (220 L) metal drum. The temporary assembly shall be located where it is accessible for mail delivery but placed as far as possible from the traveled roadway. The apparent owner of the existing mailbox shall be contacted and allowed to take possession of the existing mailbox and assembly. If the owner refuses to take possession, the existing mailbox and assemblies shall be removed.

Mailbox assemblies shall be furnished and installed as shown on the plans. Alternate mailbox assemblies which have been crash tested and approved in accordance with NCHRP 350 requirements may be considered upon receipt of a written request. Alternate mailbox assemblies approved for use shall be furnished and installed in conformance with the manufacturer's recommendations.

Mailboxes complying with the requirements of the United States Postal Service, including markings and sizes, shall be furnished and installed with the mailbox assembly. The mailbox shall be of comparable size to the existing mailbox previously removed from the highway right-of-way. The markings shall include "approved by U.S. Postmaster" stamped on the mailbox by the manufacturer and the address number, box number, or house number, in 2 in. (50 mm) or larger reflective material placed on the side of the mailbox in view of motorists in the nearest travel lane.

611.04 Method of Measurement

Mailbox assemblies will be measured by the number of units installed.

611.05 Basis of Payment

Mailbox assemblies will be paid for at the contract unit price for each, complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
Mailbox Assembly, Double.....	EACH
Mailbox Assembly, Single	EACH

The cost of wood or pipe posts, support hardware, mailbox, and removal of existing mailbox and its assembly shall be included in the cost of the mailbox assembly.

SECTION 612 – UNDERSEALING

612.01 Description

This work shall consist of furnishing and pumping an asphalt material under cement concrete pavement in accordance with 105.03.

MATERIALS

612.02 Materials

- 10 Utility asphalt, UA-II or UA-III shall be in accordance with 902.01(d).

CONSTRUCTION REQUIREMENTS

612.03 Shoulders

All holes, low areas, or displaced areas in the shoulders immediately adjacent to the pavement edge shall be filled with loam, clay, or other approved material and compacted to the elevation of the pavement. Such areas, including all other shoulder areas immediately adjacent to the pavement edge, shall be compacted with a roller or another approved method.

20

612.04 Drilled Holes

Where the existing pavement has transverse joints, holes not to exceed 1.5 in. (38 mm) in diameter shall be drilled on the centerlines of the pavement lane to be treated. Such holes, unless otherwise directed, shall be located longitudinally between transverse joints or cracks at approximately 30 to 36 in. (750 to 900 mm) from the joints or cracks. Intermediate holes, if necessary, shall be spaced as directed.

- 30 If the existing pavement does not have transverse joints, holes not to exceed 1.5 in. (38 mm) in diameter shall, unless otherwise permitted or directed, be located on the centerline of the pavement lane to be treated and be spaced as directed.

An approved method shall be used to prevent the drill from entering the subgrade after penetrating the pavement. Automatic stops on mechanical equipment and marked drill bits on hand operated jackhammers may be approved subject to satisfactory operation.

- 40 Just prior to pumping operations, the surface of the pavement around each hole for an area of at least 1/2 the width of the lane being treated shall be thoroughly sprinkled with water to prevent the undersealing material from adhering to the pavement surface.

612.05 Pumping Asphalt

After the above procedure is complete, the asphalt shall then be pumped through the holes and under the pavement with an approved type of self-propelled pressure distributor, the pressure to be as directed. A metallic hose shall connect the asphalt

tank through an asphalt pump to a 1 in. (25 mm) nozzle and a return metallic hose shall connect the nozzle to the asphalt distributor tank.

- 50 The nozzle shall be equipped with a three way valve so designed that the asphalt may circulate back to the distributor tank when pumping operations are not in progress. The nozzle shall be inserted in the hole, driven to a snug fit, and pumping of the asphalt continued until the undersealing is complete, or to such other amount as directed. In case of an existing asphalt resurface on concrete, holes shall be drilled through the resurface and the underlying concrete and the nozzle shall be of sufficient length that it can be driven to a snug fit into the concrete without the upper part of the nozzle being below the elevation of the existing asphalt resurface. Upon completion of the pumping operation, the nozzle shall be removed and a wood plug driven into the hole without an excessive back flow of asphalt material. After the
60 material has hardened, the plug shall be removed and a hardwood plug at least 3 in. (75 mm) long and a minimum of 1/16 in. (2 mm) larger than the diameter of the drilled hole shall be driven flush with the surface of the concrete pavement. All material extruded during the pumping operations shall be immediately cleaned from the pavement surface and removed from the limits of the contract within a period of 24 h.

- Where undersealing operations are being performed under traffic, necessary signs, barricades, watchers, and flaggers shall be used to maintain one lane traffic in the immediate vicinity of pumping operations. Traffic may be permitted to use the
70 pumped areas upon removal of the original plugs and after the hardwood plugs are driven.

All storage tanks, pipes, retorts, booster tanks, and distributors used for storing or handling the asphalt materials shall be kept clean and in good operating condition at all times so there is no contamination of the materials.

- The asphalt shall not be heated above 500°F (260°C) at any time and, when pumped under the pavement, the temperature shall be no less than 350°F (177°C). All material heated beyond 500°F (260°C) shall be rejected.
80

No material shall be applied on a frozen subgrade nor when the atmospheric temperature is 40°F (4°C) or lower and falling. The asphalt shall be placed only when general weather conditions are suitable.

When directed, certain portions may be required to be undersealed a second time. The number of holes involved in this second undersealing shall not exceed 5% of the number of holes indicated in the Schedule of Pay Items.

612.06 Method of Measurement

- 90 Asphalt material will be measured by the ton (megagram). Drilled holes for underseal will be measured per each hole drilled.

612.07

612.07 Basis of Payment

This work will be paid for at the contract unit price per ton (megagram) for asphalt material for underseal. Drilled holes for underseal will be paid for at the contract unit price per each, complete in place.

Additional holes and materials required for a second undersealing operation will be paid for at the contract unit prices for the quantities involved.

100

Payment will be made under:

Pay Item

Pay Unit Symbol

Asphalt Material for Underseal	TON (Mg)
Drilled Hole for Underseal	EACH

The cost of shoulder material, wood and hardwood plugs, and necessary incidentals shall be included in the cost of the pay items.

110

SECTION 613 – SALVAGED ROAD MATERIALS

613.01 Description

This work shall consist of removing approved material from an existing road within the limits of the contract, including intersecting approaches, and using it in reconstruction of the road in accordance with these specifications or as directed.

613.02 Materials

10 Approved materials may be asphalt treated or untreated gravel, stone, slag, or all combinations of these or other materials which are suitable for salvaging.

613.03 Construction Requirements

Before any filling or further work is done at locations where material is to be salvaged, such material shall be removed and stored in stockpiles outside the construction limits and adjacent thereto, or it may be incorporated directly into the work without stockpiling if conditions permit.

20 The quantities removed, if available, shall be sufficient to complete the item of work or certain portions thereof for which it is intended. The depth of excavation shall be as directed.

The incorporation of the salvaged material into the work shall be in accordance with applicable provisions of the specifications for which the material is to be used or in accordance with the special provisions, depending on the nature of the material and the use to which it is put.

613.04 Method of Measurement

Salvaged road material will be measured by the cubic yard (cubic meter) in stockpiles after removal from its original position or, if the Contractor prefers, it will
 30 be measured by the cubic yard (cubic meter) in its original position. All measurements will be made by means of cross sections. The volumes will be computed by the average end area method.

If salvaged road material is used as subbase, the combined pay quantities of subbase and salvaged road material for subbase shall equal but shall not exceed the total theoretical volume as calculated to the neat lines shown on the plans for subbase. If the volume of salvaged road material used as subbase determined by the cross section method does exceed the total theoretical volume of subbase, the final
 40 pay quantity for salvaged road material for subbase shall be the total theoretical volume.

The final pay quantity of subbase will be determined by deducting the final pay quantity of salvaged road material for subbase from the total theoretical volume of subbase.

If salvaged road material is obtained from within the pay limits of the new construction, such cubic yardage (cubic meterage) of salvaged material will be deducted from the excavation quantities to be measured for payment.

50 613.05 Basis of Payment

The accepted quantities of salvaged road material for the use shown on the Schedule of Pay Items will be paid for at the contract unit price per cubic yard (cubic meter), complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
Salvaged Road Material for _____	CYS (m3)

60 The cost of removal of the material, storage, incorporating it into the work, and necessary incidentals shall be included in the cost of the pay item.

SECTION 614 – CONCRETE HEADER**614.01 Description**

This work shall consist of the construction or reconstruction of PCC headers adjacent to railroad tracks, bridges, and similar locations in accordance with 105.03.

MATERIALS

614.02 Materials

- 10 Materials shall be in accordance with the following:

Concrete	702
Reinforcing Steel.....	910.01

If the header is adjacent to cement concrete base or pavement, the header concrete shall be the same composition as that of the base or pavement header constructed monolithic with the base or pavement. If the adjacent base or pavement is thickened, that portion forming the thickening shall be considered as part of the header.

20

If the header is adjacent to asphalt pavement, the concrete shall be class A in accordance with 702 using class AP coarse aggregate.

CONSTRUCTION REQUIREMENTS

614.03 PCC Header

Construction shall be in accordance with the applicable provisions of 702 and with these requirements.

- 30 Welding shall be in accordance with 711.32.

Headers at railroad crossings shall be as shown on the plans.

614.04 Reconstructed Cement Concrete Header

This work shall be in accordance with the plans. Round plug welds or rectangular shaped plug welds may be used to weld the steel angle to the existing steel edge protection. Round plug welds shall be a minimum of 1 in. (25 mm) diameter.

- 40 Welding shall be in accordance with 711.32.

614.05 Method of Measurement

Cement concrete header and reconstructed cement concrete header will be measured by the linear foot (meter).

614.06 Basis of Payment

The accepted quantities of this work will be paid for at the contract unit price per linear foot (meter) for header, cement concrete, of the type specified, or header, cement concrete, reconstruct, complete in place.

50

Payment will be made under:

Pay Item**Pay Unit Symbol**

Header, Cement Concrete, _____ LFT (m)
type

Header, Cement Concrete, Reconstruct..... LFT (m)

60 The cost of edge protection, metal chairs, excavation, and necessary incidentals shall be included in the cost of the pay items.

SECTION 615 – MONUMENTS, MARKERS, AND PARKING BARRIERS**615.01 Description**

This work shall consist of furnishing and setting, setting only, or resetting right-of-way markers, monuments for marking section or other lines, bench mark posts and tablets, and parking barriers in accordance with 105.03.

MATERIALS**10 615.02 Materials**

Materials shall be in accordance with the following:

Coarse Aggregate, Class A or Higher,	
Size No. 8 or 91	904
Fine Aggregate, Size No. 23.....	904
Portland Cement.....	901.01(b)
Reinforcing Steel.....	910.01

615.03 Reinforced Cement Concrete Right-of-Way Markers

20 These markers shall conform with the dimensions and lettering shown on the plans. The reinforcement shall be securely held in place by at least four spacers of an approved design. The concrete ingredients shall be graded and proportioned to produce a strong dense concrete.

When tested as hereinafter described, a specimen shall support a total load of at least 2,400 lb (10 700 N) before the first crack appears. The specimen will be tested as a simple beam. The distance between supports shall be exactly 24 in. (600 mm) with the load applied at the rate of approximately 1200 lb (5400 N) per min in the center of the span. Loading will continue until the first crack appears.

30

The cement concrete shall absorb no more than 8% water. Specimens for absorption may be taken from the markers tested for strength. The absorption test shall be as described in accordance with AASHTO T 280 except the specimen tested shall be the full cross section marker.

The markers shall have a smooth workmanlike finish free from cracks, patches, honeycomb, exposed reinforcement, and excessive bubble holes. Each marker shall

615.04

be plainly marked near the bottom with the trademark or initials of the manufacturer and the date of manufacture. These letters and figures shall be no less than 1 in. (25 mm) in height and shall be indented 1/8 in. (3 mm).

Right-of-way markers furnished under this specification shall be covered by a type C certification in accordance with 916.

615.04 Monuments

Monuments shall be of the type specified in the Proposal book, the details of which are shown on the plans. Any portion extending above the ground shall be finished in accordance with 702.21.

50 Where concrete is required, it shall be class A in accordance with 702. When placed in the forms it shall be tamped in layers until mortar covers the outer surface. The tops of the monument shall be floated smooth. Monuments may be cast in place or cast outside and then set.

The pin shall be set perpendicular to and flush with the top of the monument while the concrete is plastic and left undisturbed until the concrete has set. The pin shall be copper and shall be 1 in. (25 mm) in diameter and 5 in. (125 mm) long. If for type D monuments, the hole shall be drilled in the center with a 1/8 in. (3 mm) drill for a depth of 1.5 in. (38 mm). The hole shall be filled with lead flush with the end of the pin. Castings for protected monuments shall be in accordance with 910.05(a).

615.05 Bench Mark Posts

Bench mark posts shall be of the dimensions shown on the plans and cast in accordance with applicable provisions of 615.03, except the strength shall be determined by concrete cores taken from the finished product. At least two concrete cores will be taken from each unit and the average strength of the unit shall be at least 4000 psi (28 MPa) with no individual core strength less than 3600 psi (25 MPa). Tablets will be furnished by the Department and shall be set in the posts as indicated on the plans.

70

615.06 Parking Barriers

Parking barriers shall be of the dimensions shown on the plans. The barriers shall be cast and tested in accordance with the applicable requirements of 615.03, except the strength shall be determined by concrete cores taken from the finished product. At least two concrete cores will be taken from each unit and the average strength of the unit shall be at least 4000 psi (28 MPa) with no individual core strength less than 3600 psi (25 MPa).

CONSTRUCTION REQUIREMENTS

80

615.07 Setting Right-of-Way Markers

The back face of these markers shall be set on the right-of-way lines approximately 1,000 ft (300 m) apart as hereinafter provided. They shall be set at all

corners of irregular right-of-way lines, opposite each P.C. and P.T. of curves, and not to exceed 500 ft (150 m) apart on the inside and outside of curves. Care shall be used in locating markers on tangents so that a marker is plainly visible from each of those adjacent.

- 90 Markers shall be set plumb, to the depth required on the plans, and with the letters facing the pavement. Portions of the holes not occupied by markers shall be backfilled and compacted in layers with suitable material up to the level of the original ground. The markers shall not be displaced during backfilling.

615.08 Resetting Right-of-Way Markers

When the proposal provides that existing right-of-way markers be reset, the existing markers shall be removed and reset at designated locations in accordance with 615.07.

615.09 Setting Monuments

- 100 If the location of a monument falls within the limits of a cement concrete pavement, a copper pin, the details of which are shown on the plans, shall be set perpendicular to and flush with the top of the finished pavement. It shall be placed just before the concrete takes initial set and then left undisturbed until the concrete has set. Other monuments shall be of the type shown on the plans, depending on the type or surface of the pavement in which they are to be placed or if they are to be placed outside of pavement. Necessary excavation shall be to the required depth. The bottom of the excavation shall be firm and true to line and grades given. After a monument is in place, the remaining excavated areas shall be backfilled with suitable material firmly tamped in layers. The monument shall not be disturbed.

110

Existing monuments which are not required to be disturbed or re-established, but which are disturbed during construction operations, shall be re-established.

615.10 Re-Established Monuments

It may be necessary to re-establish existing monuments in pavements or bases which are disturbed unavoidably or covered by operations embraced in the contract.

- 120 If the existing monument is, or contains a brass or copper pin, the pin shall be extended to the surface of the new pavement by attaching a brass or copper pin with at least a 1 in. (25 mm) diameter and of the length required. Such extensions shall be attached by tapping the original pin and providing a necessary screw attachment such that the extension can be fastened securely to the original pin. The tapped hole shall be at least 0.25 in. (6 mm) in diameter and no less than 1 in. (25 mm) deep. The screw attachment shall have the same diameter as for the hole in the original pin and shall be no less than 1 in. (25 mm) in length.

Where an existing monument of the type specified above has not been re-established on a previous contract, the monument shall be re-established in the same manner as set out above.

130

Where existing monuments are protected and encased in cast iron, such castings shall be adjusted to meet the elevation of the proposed surface by means of an asphalt coated, cast iron, adjustment casting. The size shall be the same as the original casting and of the depth necessary to meet the elevation of the proposed new surface.

615.11 Setting Bench Mark Posts and Tablets

Bench mark posts shall be set at locations marked on the plans or as directed. Excavation shall be to the depth indicated and to dimensions sufficient to provide for the concrete backfilling. This concrete shall be class A and shall extend for 6 in. (150 mm) around and below the post. The bottom shall be monolithic with the sides. The remainder of the excavation up to the original ground line shall be backfilled with suitable material well tamped in layers. Care shall be taken not to disturb the post. When specified on the plans, or directed, bench mark tablets furnished by the Department shall be placed in newly constructed or existing drainage structures located within the limits of the contracts.

615.12 Reset Bench Mark Posts

When the Proposal book provides that existing bench mark posts be reset, the existing bench mark posts shall be removed and reset at designated locations in accordance with 615.11.

615.13 Method of Measurement

Right-of-way markers, reset right-of-way markers, monuments, re-established monuments, castings adjusted to grade monuments, bench mark posts, and reset bench mark posts will be measured by the number of units installed. Parking barriers will be measured by the number of units installed.

615.14 Basis of Payment

The acceptable quantities of right-of-way markers, reset right-of-way markers, monuments, re-established monuments, castings adjusted to grade monuments, bench mark posts, and reset bench mark posts, and parking barriers will be paid for at the contract unit price per each complete in place.

Payment will be made under:

	Pay Item	Pay Unit Symbol
	Bench Mark Post	EACH
	Bench Mark Post, Reset	EACH
	Casting Adjusted to Grade, Monument	EACH
	Monument, _____	EACH
	type	
	Monument, Re-Establish	EACH
	Parking Barrier	EACH

170

616.04

Right-of-Way Marker	EACH
Right-of-Way Marker, Reset	EACH

- 180 The cost of setting tablets in structures or bench mark posts, extensions for monuments, adjustment castings, re-establishing disturbed existing monuments, and other necessary incidentals shall be included in the cost of the pay items.

SECTION 616 – RIPRAP AND SLOPEWALL

616.01 Description

This work shall consist of placing broken stone or concrete which may or may not be grouted, precast slabs, or sloped wall in accordance with these specifications and in accordance with 105.03.

MATERIALS

10 616.02 Materials

Materials shall be in accordance with the following:

	Asphalt Joint Filler	906.01
	Clay	903.01
	Concrete, Class A	702
	Fine Aggregate, Size No. 23.....	904
	Geotextile	918.02
	Portland Cement	901.01(b)
	Precast Concrete Riprap	904.04(e)
20	Riprap	904.04
	Water	913.01
	Welded Steel Wire Fabric	910.01(b)5

Welded wire fabric shall be 6 in. by 6 in. (150 mm by 150 mm) mesh, W-3 x W-3 wires, with a weight (mass) per square area of 42 lb/100 ft² (205 kg/100 m²).

CONSTRUCTION REQUIREMENTS

616.03 Placing Dumped Riprap

- 30 Dumped riprap shall be placed to produce a surface of approximate regularity but need not necessarily be hand placed. The finished surface shall vary no more than 9 in. (225 mm) from a true plane. The thickness perpendicular to its surface shall be no more than 2 ft (0.6 m) nor less than 1 ft (0.3 m) unless otherwise directed.

616.04 Placing Grouted Riprap

The aggregate, preparation of the slope, and the depth of riprap aggregate for grouted riprap shall be in accordance with 616.05. After the aggregate has been placed and accepted, all openings shall be filled with cement grout. The finished surface shall be approximately smooth, solid, and true to line, grade, and section.

40

Grout shall be composed of one part portland cement and four parts fine aggregate. The portland cement and fine aggregate shall be dry-mixed to a uniform mixture. Water shall be added as the mixing continues until the grout attains a consistency that will allow it to flow into the openings.

616.05 Placing Revetment, Class 1, and Class 2 Riprap

Revetment, class 1 and class 2 riprap may be placed by dumping and shall be placed to the required thickness. The finished surface shall be free from clusters of small stones or of large ones. The finished surface shall vary from a true plane no
50 more than 9 in. (225 mm) for revetment riprap or 18 in. (450 mm) for class 1 or class 2 riprap but shall not be less than the minimum depth specified.

616.06 Placing Uniform Riprap

Uniform riprap shall be placed to produce a surface of approximate regularity with edges having projections no more than 3 in. (75 mm) above the required cross section. The material shall be hand laid or placed by other approved means.

616.07 Blank

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616.08 Placing Precast Cement Concrete Riprap

The slope on which the riprap is to be placed shall be in accordance with that shown on the plans unless otherwise designated. Laying shall begin in a trench below the toe of the slope and progress upward. Each piece shall be laid by hand perpendicular to the slope. It shall be firmly embedded against the slope in such a manner that the vertical joint space between individual units does not exceed 3/8 in. (10 mm), unless otherwise permitted. Half blocks, odd shaped blocks, or class A concrete shall be used to fill the voids at the ends of sections to be placed or on curved shaped sections. The top course shall conform, as nearly as practicable, with the prescribed berm or shoulder elevation. Any adjustment necessary to achieve this
70 shall be obtained by constructing a wedge course near the top of the slope as directed. This wedge course, when required, shall consist of class A concrete. If the thickness of the course does not permit class A concrete, it shall be constructed of a 1:2 mortar proportioned by volume. Toewalls, when required, shall consist of class A concrete.

616.09 Slopewall

The slope on which slopewall is to be placed shall be in accordance with that shown on the plans unless a different slope is designated.

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The concrete mixture shall be class A. Where paved slopewall abuts or surrounds columns, piers, or other structures, 5/8 in. (15 mm) of asphalt joint filler shall be used between the slopewall and such structure. Welded steel wire fabric shall be placed within the middle third of the slopewall thickness unless otherwise directed. The fabric shall extend through all construction joints. The surface of the

sloped wall shall be cured for 48 h in accordance with 501.20. Construction joints may be either butt or keyway type.

Inspection holes shall be provided at the locations shown on the plans or as directed. The holes shall be approximately 3 ft by 3 ft (1 m by 1 m) in size.

90

Precast concrete riprap, type B, as shown on the plans, may be used in lieu of sloped wall of 4 in. (100 mm) thickness.

616.10 Undermined Paved Side Ditch

Treatment of undermined existing paved side ditch and placement of revetment riprap shall be as shown on the plans or as otherwise directed.

Undermined paved side ditch shall be broken up and left in place. If it is determined that erosion is excessive, the eroded area shall be backfilled with a cohesive material, compacted, regraded, and lined with revetment or uniform riprap.

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616.11 Installation of Geotextile Under Riprap

Storage and handling of geotextiles shall be in accordance with the manufacturer's recommendations, except that the geotextile shall not be exposed to direct sunlight, ultraviolet rays, water, temperature greater than 140°F (60°C), mud, dirt, dust, and debris, to the extent that its strength, toughness, or permeability requirements are diminished. Each geotextile roll shall be labeled or tagged to provide product identification sufficient for inventory and quality control purposes. Exposure of geotextiles to the elements between lay down and cover shall be a maximum of 14 days. At the time of installation, the geotextile shall be rejected and replaced with no additional payment if defects, rips, flaws, deterioration or damage incurred during manufacture, transportation, storage, or construction is evident.

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The surface to receive the geotextile shall be prepared to a relatively smooth condition free of obstructions, depressions, and debris within the limits indicated on the plans.

Geotextiles used along channels shall be placed with the machine direction of the geotextile parallel to the channel. Successive geotextile sheets shall be overlapped in such a manner that the upstream sheet is placed over the downstream sheet and the upslope sheet over the downslope sheet.

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Geotextiles used for 2:1 slopes or greater shall be placed with the machine direction of the geotextile sheets perpendicular to the toe of slope. The geotextile sheets shall be overlapped in the direction of the anticipated movement of water.

Adjacent pieces of geotextile may be joined by sewing if approved, or by overlapping and pinning. The minimum overlap shall be 18 in. (460 mm) except when placed under water. When placed under water, the overlap shall be a minimum of 3 ft (1 m). Securing pins shall be steel, 3/16 in. (5 mm) in diameter, 18 in.

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616.12

(460 mm) long, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of no less than 1.5 in. (38 mm). Securing pins with washers shall be inserted through both strips of overlapped geotextile at spacing intervals in Table 1 along a line through the midpoint of the overlap. The geotextile strip shall be placed so that the lower strip will be overlapped by the next higher strip. Pins shall be driven until the washer bears against the geotextile and secures it firmly to the ground.

140 Whether the fabric is joined by sewing or pinning, additional pins shall be installed as necessary to prevent any slippage of the fabric regardless of location.

TABLE 1

Slope	Pin Spacing
steeper than 3:1	2 ft (0.5 m)
3:1 to 4:1	3 ft (1.0 m)
4:1 or flatter	5 ft (1.5 m)

150 The geotextile shall be placed in such a manner that placement of the overlying materials will not excessively stretch or tear the geotextile and will not pull the required overlap or seam apart. Construction equipment will not be allowed on the exposed geotextile. Placement of riprap or stone shall start from the base of the slope, moving upslope and from the center outward. Riprap shall not be allowed to roll downslope and the height of drop for riprap shall be kept to less than 2 ft (0.6 m).

616.12 Method of Measurement

Dumped, revetment, class 1 and class 2 riprap obtained from outside the right-of-way will be measured by the ton (megagram). If obtained from inside the right-of-way, no measurement will be made if placed as shown on the plans unless direct payment is specified. If placed at locations not shown on the plans, measurement will be made by the square yard (square meter).

160 Grouted riprap and precast concrete riprap, including the area occupied by the wedge course, will be measured by the square yard (square meter), parallel to the slope. Slopewall will be measured by the square yard (square meter). Holes for inspecting slopewalls will be measured per each. Geotextiles used under riprap will be measured by the square yard (square meter), complete in place. Uniform riprap will be measured by the ton (megagram).

Treatment of undermined paved side ditch will be measured by the linear foot (meter) of paved side ditch, broken and left in place.

616.13 Basis of Payment

170 The accepted quantities of dumped, revetment, class 1, and class 2 riprap obtained from outside the right-of-way will be paid for at the contract unit price per ton (megagram). Dumped, revetment, class 1, and class 2 riprap obtained from

within the project limits will be paid for at the contract unit price per square yard (square meter). Uniform riprap will be paid for at the contract unit price per ton (megagram). Grouted riprap will be paid for at the contract unit price per square yard (square meter) of the specified depth. Precast concrete riprap, and concrete slopewall will be paid for at the contract unit price per square yard (square meter), all complete in place. If slag is used as dumped riprap and payment will be made per ton (megagram), the pay quantity will be adjusted in accordance with 904.01.

180

The accepted quantities of geotextiles used under riprap will be paid for at the contract unit price per square yard (square meter), complete in place.

Inspection holes will be paid for at the contract unit price per each.

The treatment of undermined paved side ditch will be paid for at the contract unit price per linear foot (meter) for paved side ditch, break. Backfill required for treatment of paved side ditch will be paid for at the contract unit price per cubic yard (cubic meter) for borrow, cohesive.

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Payment will be made under:

	Pay Item	Pay Unit Symbol
	Borrow, Cohesive	CYS (m3)
	Geotextiles	SYS (m2)
	Inspection Hole	EACH
	Paved Side Ditch, Break	LFT (m)
	Riprap, Class _____	TON (Mg)
200		SYS (m2)
	Riprap, Dumped	TON (Mg)
		SYS (m2)
	Riprap, Grouted, _____ in. (mm)	SYS (m2)
	depth	
	Riprap, Precast Concrete	SYS (m2)
	Riprap, Revetment	TON (Mg)
		SYS (m2)
	Riprap, Uniform	TON (Mg)
	Slopewall	SYS (m2)
210	Slopewall, Concrete, _____ in. (mm)	SYS (m2)
	depth	

If the contract includes a pay item for removing materials from within the project limits which are used as grouted riprap, the cost of such removal shall be included in the cost of the pay item for the removal work. The cost of placing such material shall be included in the cost of the riprap pay item.

The cost of paved side ditch required at the top of riprap and along the edge of riprap will be paid for in accordance with 607.06. The cost of welded steel wire fabric shall be included in the cost of the slopewall.

The cost of excavation below the finished riprap or slopewall shall be included in the cost of the riprap and slopewall pay items. The cost of excavation, grading, sewing, pinning, and necessary incidentals shall be included in the cost of geotextiles.

SECTION 617 – BLANK

SECTION 618 – BLANK

SECTION 619 – PAINTING BRIDGE STEEL

619.01 Description

This work shall consist of preparing surfaces and applying paint to steel bridges in accordance with these specifications or as directed.

MATERIALS

619.02 Materials

Materials shall be in accordance with the following:

Epoxy Intermediate Paint	909.02(b)
Finish Coat for Weathering Steel	909.02(e)
Inorganic Zinc Primer.....	909.02(a)1
Organic Zinc Primer.....	909.02(a)2
Polyurethane Finish Coat	909.02(c)
Single Component Inorganic Zinc Primer	909.02(a)2
Structural Steel Coating Systems	909.03
Waterborne Finish Paint	909.02(d)

Material safety data sheets shall be provided in the QCP for all materials to be delivered to the project site.

CONSTRUCTION REQUIREMENTS

619.03 Quality Control and Quality Assurance

The Contractor shall be responsible for the quality of work on the contract and shall ensure that all work has been performed by accepted quality control methods. A QCP shall be prepared and submitted by the Contractor in accordance with ITM 803.

The QCP shall contain information specific to each bridge in the contract and shall be well organized in content. The QCP shall be submitted at least 15 work days prior to commencing this work. No work may begin until written notice has been received

that the QCP was accepted by the Engineer. The QCP manager shall furnish the current SSPC Structural Steel Painting Manual, Volumes 1 and 2, at the project site.

The painting Contractor shall be certified SSPC-QP 1 for cleaning and painting bridge steel which does not have lead coatings and certified SSPC-QP 2 for cleaning and painting bridge steel which does have lead based coatings. Evidence of the certifications shall be provided in the QCP. A QCP manager and QC technicians
40 shall also be identified in the QCP.

The Department will accept work performed on the project through quality assurance inspections and testing. Acceptance testing will be performed and will be the basis for which acceptance will be made.

(a) Acceptance Testing Definitions

The following definitions of terms shall apply to acceptance testing of painting steel bridge work.

50 1. Lot

A lot shall be a series of tests performed on each phase for each 1076 sq ft (100 m²) or portions thereof.

2. Series

A series shall be 10 random tests performed by the Engineer on a lot.

3. Phase

A phase shall be painting operations consisting of either the cleaning of steel or the application of each coat of paint.

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(b) Testing Procedure

During acceptance testing, the results of the random testing within a series will be compared to the specified requirements for that phase of work. A series of spot measurements spaced evenly over each lot will be made. The average of 10 spot measurements for each lot shall not be less than the specified thickness. A single spot measurement in any lot shall not be less than 80% of the specified thickness. A reading below the minimum of the average of 10 spot measurements less than the specified thickness shall be considered a defect. If there is only one defect for the series of tests, the lot will be accepted provided there are no visual defects. If two
70 defects are found in the first series of tests, then a second series of tests for each lot shall be measured. If three defects are found in the first series of tests, then the lot fails. If the first and second series of tests have four or less defects, both series pass. If there are more than four defects, then the lot fails.

If a lot fails, corrective action shall be taken to make the lot acceptable. Corrective action shall be submitted in writing and performed as approved. A failed lot shall not be covered until the whole lot has been accepted.

(c) Test Methods and Procedures

- 80 The current version of the following test methods and procedures shall be performed as a minimum for quality control by the Contractor. These and other tests may be performed for acceptance testing by the Engineer.

TEST/PROCEDURE	METHOD AND PROCEDURE
Surface Profile	ASTM D 4417
Clean Compressed Air	ASTM D 4285
Cleaning of Steel	SSPC Vis 1, Vis 3, and ISO 8501-1
Dry Film Thickness	SSPC PA 2
90 State of Cure of Inorganic Zinc Primers	ASTM D 4752
Relative Humidity.....	ASTM E 337

619.04 Prosecution of Work

- Prosecution of work shall be in accordance with the applicable requirements of 108.03. Once the operations of cleaning and painting have begun, it shall be performed on all work days without stoppage until all work has been completed. If the contract contains more than one bridge, a schedule shall be included in the QCP which provides the sequence of work on the bridges. When work has begun on a bridge, it shall be performed until complete, including all cleanup.

- 100 Permission shall be obtained in writing to start or continue work at the hold points as follows:

- (a) prior to the acceptance of the QCP and start of work;
- (b) immediately following a surface preparation phase;
- (c) immediately before the application of the first coat;
- (d) prior to the application of each succeeding coat; and
- (e) after the final coat has cured.

- 110 A minimum of one day's notice shall be given in advance of each of the hold points.

619.05 Inspection Access to Bridges

Safe and reasonable access to all points of the bridge shall be provided for the Engineer's inspections immediately upon request. The inspection access equipment shall be obtained, maintained, and kept in safe working order.

619.06 Maintaining Traffic

- 120 The traffic lanes may be restricted when surface preparation or painting phases are being performed on a portion of the bridge over the traveled roadway, or as directed, when the need exists. A traffic maintenance plan shall be provided in the QCP and shall be in accordance with the plans.

Construction signs in accordance with 801.04 shall be furnished and placement at each project site shall be as shown in the QCP. However, a “Bridge Painting Ahead” sign may be used in place of the “Road Construction Ahead” sign.

- 130 The traffic maintenance plan shall include a type of barrier system which shall protect against blasting of vehicles or pedestrians, eliminate abrasive materials and debris from falling onto the traveled portion of the pavement, and prevent the spreading of abrasive materials and debris in the area which may create a traffic hazard. If the intended purpose of the protective devices has not been accomplished, work shall stop until adequate corrections have been made. All abrasive material or debris shall be removed by the end of each day’s work in accordance with 619.07.

619.07 Environmental and Safety Requirements

Pollution control and waste disposal of existing paint and debris shall be in accordance with the following requirements.

- 140 The QCP shall contain a written description of the Contractor’s hazardous waste training program in accordance with 40 CFR 265.16 and ITM 803. Likewise, the waste contingency plan shall be contained in the QCP and in accordance with ITM 803.

- 150 A health and safety plan shall be provided in the QCP and in accordance with ITM 803. Workers shall be protected in accordance with IOSHA requirements. All personnel on the project site shall wear personal protective equipment. The protective equipment shall be furnished by the Contractor, including to Department personnel. Training shall be given to all personnel provided with the protective equipment. Protective equipment shall include, but not be limited to, clean air supplied respirators, air purifying respirators, conventional hood as applicable, eye protection, and protective clothing. Two rooms for changing and washing shall be provided on lead primed bridges.

(a) Pollution Control

The containment procedure plan shall be provided in the QCP. The telephone numbers for the IDEM Emergency Response Branch, local health department, and all water intake users within 500 ft (150 m) shall be provided in the QCP.

- 160 Blasting materials, scrapings, wire brushings, and paint particles shall be contained in accordance with SSPC-Guide 6 (CON), Class 3, specifically for zinc primed bridges, and SSPC-Guide 6 (CON), Class 2, for lead primed bridges.

If a spill, as defined in IDEM Regulation 327 IAC 2-6 does occur, all work shall stop and immediate action shall be taken to clean up the site. Spills of material, which enter or threaten to enter the water, shall be handled in accordance with IDEM Regulation 327 IAC 2-6. The IDEM Emergency Response Branch, the local health department, and all water intake users within 500 ft (150 m) of the bridge shall be immediately contacted and advised of the spill. Written documentation of all such

- 170 contacts and actions shall be kept. All applicable Federal, State, and local rules and regulations described in 619.07(b)1 shall be observed.

On bridges with lead paint, steel grit blasting abrasives shall be used and recycled. The recycling equipment shall be capable of separating the blasting abrasive from the paint debris. The residue from the bridge shall be sampled within the first five days of removal and shipped to be tested. Residue shall be placed in an approved container. Such containers shall be properly labeled and maintained to comply with 40 CFR 264.

- 180 No waste shall remain on the booms or on the water surface overnight. All blasting debris shall be cleaned up after each day's work. All waste material shall be properly stored at the project site to prevent loss or pollution.

(b) Waste Disposal

Disposal of existing paint and debris shall be in accordance with SSPC-Guide 7 (DIS) and the following requirements.

1. Laws to be Observed

- 190 Federal and State laws and regulations regulate the disposal of bridge painting debris. Bridge paint debris shall be manifested or certified and shall be disposed of at an appropriate disposal facility.

The Contractor shall have direct knowledge regarding compliance with laws pertaining to pollution control and waste management such as follows.

- a. subtitle C of the Resource Conservation and Recovery Act, 40 CFR 261, 262, 263, 265, and 268;
- b. the Solid Waste Rule, 329 IAC 2;
- 200 c. the Hazardous Waste Rule, 329 IAC 3;
- d. the Air Pollution Rule 326 IAC 4;
- e. the Water Pollution Rule, 327 IAC 2-6;
- f. the United States Department of Transportation regulations 49 CFR 172.300; and
- 210 g. OSHA worker safety regulations 29 CFR 1926.

2. Time Limitations

The maximum time limit from the date the generated waste is placed in a container and the date the material is transported to a permitted treatment, storage, and disposal facility shall be 90 calendar days.

3. Marking of Spent Material Containers

Spent material containers shall be marked with the date that waste is first placed in the container. Until laboratory results are received concerning the category of the waste, the containers shall be labeled "LEAD PAINT WASTE DEBRIS" or "ZINC PAINT WASTE DEBRIS", as appropriate. Labeling of containers as hazardous waste will not be required until the appropriate laboratory analysis determines the waste to be hazardous in accordance with the current RCRA hazardous waste definitions. Immediately upon notice that the waste is hazardous, the containers shall be marked in accordance with 49 CFR 172, Subpart D.

4. Instruction for Disposal of Paint Waste

Sampling and analysis of the paint waste debris shall be performed to determine if the wastes are hazardous. If the waste is not found to be hazardous in accordance with current RCRA hazardous waste definitions, the waste material shall be disposed of at an appropriate disposal facility. If the waste is found to be hazardous, IDEM shall be notified and an EPA identification number will be obtained by the Department. This will be provided to the Contractor within 30 days of the start of waste generation for bridges having hazardous waste paint debris. The waste from different bridges shall not be mixed. The Contractor shall have the responsibilities as follows:

- a. determining the location for disposal, treatment, or recycling of the waste, obtaining the Engineer's approval of the site, and arranging with the approved site for acceptance of the materials;
- b. preparing a hazardous waste manifest, as required by Federal and State requirements, for signature;
- c. scheduling the shipment of waste to the permitted disposal site;
- d. ensuring that the hazardous waste manifest is carried in the transportation vehicle;
- e. ensuring that all required hazardous materials placards are properly displayed on the vehicle;
- f. ensuring prompt movement of the vehicle to the disposal site; and
- g. returning one copy of signed manifest documents to the Engineer. A copy of the chemical and physical analysis of the waste, all deposit receipts, manifests, and required paperwork for disposal shall be given to the Engineer and all waste disposed of before the contract will be accepted.

The waste disposal site shall be identified in the QCP.

5. Instructions for Disposal of Other Project Generated Waste

The other wastes that may be generated on the project include, but are not limited to, spent solvents from cleaning of equipment and empty or partially empty containers of paint, paint thinners, spent abrasives, and solvents. The Contractor shall recycle or dispose of all project generated waste materials.

270

If the waste is defined as a hazardous waste in accordance with the current RCRA definitions, the waste shall be recycled or disposed of in accordance with 619.07(b)4. All project generated waste and the method of recycling or disposal shall be identified in the QCP.

619.08 Surface Preparation

Cleaning of steel surfaces shall be performed by a SSPC certified contractor. This requirement will not apply to the following:

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- (a) shop cleaning,
- (b) bearings at end bents,
- (c) small sections of beams at end bents or at piers with open joints, or
- (d) small sections of beams or other structural members where heat-straightening or similar repairs have taken place.

290

Surfaces to be painted shall be cleaned in accordance with SSPC classification, unless otherwise specified. The latest cleaning comparison chart available shall be provided in the QCP. Compressed air shall pass through an oil and water extractor before entering another apparatus.

Field cleaned steel surfaces shall be primed the same day as cleaned. If rust forms after cleaning, the surface shall be cleaned again before painting. Work shall be stopped when there is disagreement about whether a surface has been adequately cleaned. Written notification shall be provided specifically identifying the problem.

300

Cleaning shall be scheduled so that dust or other contaminants do not fall on wet, newly painted surfaces.

The surface profile of cleaned new steel surfaces shall not be less than 1 mil (25 μm) and not greater than 2 mil (50 μm). The surface profile of cleaned existing steel shall not be less than 1 mil (25 μm) and not greater than 3 mil (75 μm).

Pressure washing in accordance with 619.08(a) and solvent cleaning in accordance with 619.08(b) shall be performed before all other cleaning methods.

(a) Pressure Washing

310 All surfaces to be painted and the tops of pier and abutment caps shall be washed. The washing shall be accomplished by means of a low pressure power water washer with potable water. The pressure shall be between 800 and 1500 psi (5 and 10 MPa). If detergents or other additives are added to the water, the surface shall be rinsed with potable water before the detergents dries. All washed surfaces shall be completely free of all foreign matter and shall be approved prior to other surface preparation activities.

(b) Solvent Cleaning

320 After pressure washing has been approved, solvent cleaning shall be in accordance with SSPC-SP1.

(c) Near-White Blast Cleaning

Near-white blast cleaning shall be in accordance with SSPC-SP10/NACE No. 2.

(d) Commercial Blast Cleaning

Commercial blast cleaning shall be in accordance with SSPC-SP6/NACE No. 3.

(e) Hand Tool Cleaning

330 Hand tool cleaning shall be in accordance with SSPC-SP2.

(f) Brush-Off Blast Cleaning

Brush-off blast cleaning shall be in accordance with SSPC-SP7/NACE No. 4.

(g) Power Tool Cleaning

Power tool cleaning shall be in accordance with SSPC-SP3.

(h) Power Tool Cleaning to Bare Metal

Power tool cleaning to bare metal shall be in accordance with SSPC-SP11.

340 **619.09 Paint Systems**

Paint systems shall be applied in accordance with the manufacturer's recommendations. The dry film thickness of a paint coating will be measured with a calibrated film thickness gauge.

(a) Structural Steel Paint System

350 The coating system shall consist of an inorganic zinc primer with a dry film thickness of 3 mil (75µm), an epoxy intermediate coat with a dry film thickness of 4 mil (100 µm), and a polyurethane finish coat with a dry film thickness of 3 mil (75 µm) for the painting of steel bridges and other structural steel.

(b) Partial Paint System

The coating system shall consist of organic zinc primer with a dry film thickness of 3 mil (75 μm) and a waterborne finish coat with a dry film thickness of 3 mil (75 μm) for partial painting of steel bridges and other structural steel.

619.10 Painting

Painting shall be performed by a SSPC certified contractor, except as noted in 619.08. All technical data sheets containing the manufacturer's recommendations and instructions shall be provided in the QCP and in accordance with ITM 803.

360

Concrete at all junction points of concrete and steel shall be adequately shielded or otherwise protected so the application of paint on steel is full and complete, and that spraying onto the concrete is minimized.

If a blasted or painted surface is unsatisfactory, removal of the paint, thorough cleaning of the surface, and repainting or other correction will be required as directed. Where defects or damages occur in a film of any coating, all defective areas shall be removed to soundly bonded paint or bare steel and painted to the specified thickness.

370

No lettering shall be painted on bare or painted steel surfaces, except marks required for erection and project information stenciled in accordance with 619.10(g).

(a) Weather Limitations

Field painting will not be permitted between November 15 and the following April 1. Painting shall begin only when the 24 h ambient temperature is to remain above 50°F (10°C) after paint application, and the steel surface temperature is between 50 and 100°F (10 and 40°C). Coating and curing shall be done only when the relative humidity is to remain between 30 and 80%. All variations of these weather limitations to allow the use of any coating below the minimum or above the maximum temperature or humidity as may be recommended by the manufacturer shall be provided in the QCP. The pot life and induction time shall be in accordance with the manufacturer's recommendations for the existing temperature and humidity.

380

Paint shall not be applied when the air is misty, or when conditions are otherwise unsuitable. The surface temperature of the steel to be painted shall not be within 5°F (3°C) of the dew point. When painting in a protected area to eliminate the above conditions, the steel shall remain under cover until the paint is dry. All wet paint which has been exposed to excessive humidity, rain, snow, or condensation shall be permitted to dry. Damaged paint shall then be removed. The surface shall be re-cleaned and repainted as directed. The Engineer will be the sole authority to decide when work may begin or shall stop due to weather conditions.

390

(b) Storage

Paint shall be stored in accordance with the manufacturer's recommendations. If paint is permitted to remain in storage, the containers shall be turned end for end at

least once per week. The paint shall be used within the manufacturer's recommended shelf life.

400 **(c) Mixing**

Paint shall be thoroughly mixed so that the pigment is completely in suspension and the consistency is uniform. Mechanical mixers shall be used in accordance with the manufacturer's instructions. The paint shall remain in this condition during application to the steel surface. After initial mixing and before application, zinc primer shall be strained through a metal screen not coarser than the No. 30 (600 µm) sieve.

Partially empty containers of paint shall not be used. Partial mixing of containers will not be permitted. All paint containers shall remain closed until
410 needed for mixing.

(d) Thinning

When required for proper application, the thinning of field paint will be permitted. Only thinners recommended by the manufacturer and as approved shall be used. Thinners shall be added to paint in accordance with the manufacturer's recommendations. The maximum quantity added shall not exceed the manufacturer's recommendations. The thinned paint shall not exceed IDEM regulations for volatile organic compounds.

420 The Contractor shall contact IDEM and the local air pollution control board for information about any volatile organic compound regulations or restrictions. Proof of contact to these agencies shall be provided in the QCP.

(e) Application of Paint

All paint coatings shall be of colors to produce a distinct contrast with adjacent coatings, including the color of a clean steel surface.

430 Paint shall be applied by either an airless or conventional spray method which has been recommended by the paint manufacturer. The compressed air used for painting shall pass through an oil and water extractor before entering the paint pot. However, areas to be painted which are inaccessible to spray application or areas requiring touchup may be painted with brush or daubers. Epoxy intermediate and polyurethane finish paints may be applied by brushes or rollers provided the coating cures to a smooth and uniform finish.

Spray shall be adjusted to produce a uniform coating. All 90 degree edges shall be striped, and then repainted with the remaining steel surfaces. Painting techniques shall minimize dry overspray. Dry overspray shall be removed prior to application of other coatings and after application of the finish coat.

440 All paint coatings shall have a dry film thickness not less than 80% of the required dry film thickness.

(f) Curing Time

The minimum curing time between coatings shall be 24 h for inorganic zinc primers and 8 h for the epoxy intermediate coat. The curing time will vary depending on the temperature and humidity. The inorganic zinc primer shall be cured to a minimum solvent resistance rating of 4 in accordance with ASTM D 4752 prior to the application of the epoxy intermediate coat. It shall be demonstrated that the inorganic zinc primer is in accordance with this requirement. The epoxy intermediate coat shall be cured in accordance with the manufacturer's recommendations prior to the application of the polyurethane finish coat. The polyurethane finish coat shall be applied within 12 calendar days of application of the epoxy intermediate coat.

The curing time of all other paint systems or coatings shall be in accordance with the manufacturer's recommendations.

(g) Stencil Identification

After the finish coat has been approved, project identification information shall be painted with a stencil in 2 in. (50 mm) black capital letters onto the outside of both fascia beams, at the right end of the beam and near the end bent, which reads as follows:

bridge number

contract number

PAINTED _____
date

619.11 Shop Painting

All structural steel shall be cleaned in accordance with 619.08(c). All technical data sheets containing manufacturer's recommendations and instructions shall be provided in the QCP and in accordance with ITM 803.

All structural steel, except for ASTM A 709, grade 50W (ASTM A 709M, grade 345W) steel, shall receive an inorganic zinc primer, including faying surfaces of high strength bolted connections and areas in contact with concrete. When shear connectors have been specified, the top of the flange shall not be painted.

Surfaces, other than the contact surfaces described above, which are inaccessible after erection shall be painted in the shop with the full paint system required on the completed bridge.

Machine finished surfaces for sliding contact shall be coated with heavy grease as soon as practicable after being accepted, but before removal from the shop.

490 Erection marks may be painted on zinc painted surfaces. Shop painted beams shall not be loaded for shipment until the paint is dry.

ASTM A 709, grade 50W (ASTM A 709, grade 345W) steel shall be left unpainted, except as shown on the plans. Surfaces, when specified, shall be painted in accordance with 619.09(a), except the finish coat shall be in accordance with 909.02(e).

619.12 Field Painting New Steel Bridge

500 All structural steel which has been painted with inorganic zinc primer in the shop, except for steel contact surfaces and surfaces to be in contact with concrete, shall be painted with the other coatings specified for structural steel paint system in accordance with 619.09(a). All steel surfaces which become inaccessible to field painting after final erection shall be painted with all coats of structural steel paint system before structural steel is erected.

If application of the inorganic zinc primer on a steel surface is not permitted in the shop before erection of the bridge, the surfaces which are exposed shall be cleaned in accordance with 619.08(a), 619.08(b), and 619.08(c). These surfaces shall then be painted with the structural steel paint system after erection.

510

Surface areas where the inorganic zinc primer was damaged during shipping, handling, and erection shall be cleaned in accordance with 619.08(a), 619.08(b), and either 619.08(d) or 619.08(h). Likewise, all bolt and field connections shall be cleaned in the same manner. All the damaged areas, and bolt and field connections shall then be painted with the inorganic zinc primer applied in the shop. This requirement will not apply to temporary steel bridges.

Where steel surfaces have been painted with the full paint system and the paint coatings have been damaged, the affected steel surface areas shall be cleaned in accordance with 619.08(h). Structural steel paint system shall then be re-applied.

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619.13 Painting Existing Steel Bridges

The surfaces to be cleaned and painted shall include the surfaces of all steel members of the superstructure, substructure, floor beams, stringers, plates, castings, bearing assemblies, ornamental handrails, lattice work, and other steel appurtenances.

If the contract specifies clean steel bridge, the bridge steel shall be cleaned in accordance with 619.08(a), 619.08(b), and either 619.08(d) or 619.08(h). The structural steel paint system in accordance with 619.09(a) shall be used for painting.

530

If the contract specifies clean steel bridge, partial, the bridge steel shall be cleaned in accordance with 619.08(a), 619.08(b), and either 619.08(d), or 619.08(g),

619.14

or 619.08(h). The partial paint system in accordance with 619.09(b) shall be then be used for painting.

619.14 Drain Castings Treatment

Drain castings shall be satisfactorily cleaned. The castings shall not be shot-blasted. If castings are sandblasted, a brush blast technique shall be used in
540 accordance with 619.08(f).

The drain castings shall be painted with a black finish coat in accordance with 909.02(c).

619.15 Claims

No claim shall be made for damage, including but not limited to, damage for delay, increased expense, maintenance, start up costs, additional costs due to passage of time arising out of a dispute, or work stoppage relating to whether a surface was adequately cleaned or painted.

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No claim shall be made due to a greater amount of paint used in excess of the minimums required by the contract or for the stoppage of work. Each bridge shall be inspected before bidding for the exact type of primer that exists on each bridge.

619.16 Responsibility for Damage

All persons and property shall be protected from damage or injury from the surface preparation operations, paint, and painting operations. Persons and property shall include, but not be limited to, pedestrians, vehicles, and other traffic upon or underneath a bridge, all portions of the bridge superstructure and substructure, and
560 all adjacent property. The Contractor shall be responsible for damages in accordance with 107.17.

619.17 Method of Measurement

Cleaning and painting will not be measured.

Floor drain extensions will be measured per each drain extended.

The estimated weight (mass), length, and number of steel spans and type of primer shown on the plans or in the Proposal book is incidental information. Such
570 information is approximate only. The Department will not guarantee its accuracy.

619.18 Basis of Payment

Removal of paint of an existing bridge will be paid for at the contract lump sum price for clean steel bridge or clean steel bridge, partial, at the bridge number specified. The accepted quantities of existing steel bridges to be painted, or partial painted, whichever is specified, will be paid for at the contract lump sum price for paint steel bridge or paint steel bridge, partial, at the bridge number specified.

Drain extensions will be paid for at the contract unit price per each.

580

If the contract includes a pay item for maintaining traffic, such work will be paid for at the contract lump sum price for maintaining traffic, at the bridge number specified.

Environmental control devices required when cleaning and painting existing steel bridges will be paid for at the contract lump sum price for environmental control at the bridge number specified.

Payment will be made under:

590

Pay Item	Pay Unit Symbol
Clean Steel Bridge, Br. No. _____	LS
Clean Steel Bridge, Partial, Br. No. _____	LS
Drain Extension	EACH
Environmental Control, Br. No. _____	LS
Maintaining Traffic, Br. No. _____	LS
Paint Steel Bridge, Br. No. _____	LS
Paint Steel Bridge, Partial, Br. No. _____	LS

600

The cost to prepare a QCP shall be included in the cost of other pay items. The cost of providing the Department with access to the bridge, the use of special cleaning methods, handling debris containers, seasonal or weather limitations, and labor, materials, and equipment required for maintaining traffic shall be included in the cost of other pay items.

The cost of furnishing all materials, equipment, and labor required for washing, solvent cleaning, scraping, steel brushing, or other acceptable methods for removing paint in the locations directed shall be included in the cost of clean steel bridge or clean steel bridge, partial.

610

The cost of furnishing all materials, equipment, and labor to perform painting with structural steel paint system shall be included in the cost of paint steel bridge and to perform painting with partial paint system shall be included in the cost of paint steel bridge, partial. Painting will not be paid for separately, unless so specified. The cost thereof shall be included in the cost of other pay items.

620

The cost of all equipment, material, labor, testing, and disposal of spent materials and debris shall be included in the cost of environmental control. No additional payment will be made for delays from all operations undertaken for this work. The absence of an environmental control pay item shall not negate the Contractor's responsibility for complying with the environmental control requirements in all phases of this work.

SECTION 620 – BLANK

SECTION 621 – SEEDING AND SODDING

621.01 Description

This work shall consist of either or both plain and mulched seeding or placing approved sod. It includes furnishing and placing seed, fertilizer, inoculants, top soil, and mulch, if required, in a prepared seed bed or furnishing and placing sod at locations in accordance with 105.03.

MATERIALS

10

621.02 Materials

Materials shall be in accordance with the following:

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Fertilizer	914.03
Grass Seed	914.04
Grass Seed, Temporary	914.02
Leguminous Inoculants	914.06
Mulch	914.05(a)
Plastic Net	914.09(g)
Sod, including Nursery Sod.....	914.07
Top Soil	914.01
Water	914.09(a)
Wire Staples	914.09(f)

CONSTRUCTION REQUIREMENTS

621.03 Preparation of Ground Before Seeding

The area to be seeded shall be made smooth and uniform and shall be in accordance with the finished grade and cross section shown on the plans or as otherwise designated and shall be trimmed in accordance with 210.

30

The seed bed, if not loose, shall be loosened to a minimum depth of 3 in. (75 mm) before fertilizer or seed is applied. In areas of excessive vehicular traffic, such as parking of construction equipment near a bridge repair, the soil shall be loosened to a minimum depth of 6 in. (150 mm). Areas to be covered with topsoil shall be milled or disked slightly before the topsoil is placed. A disk, spike-toothed harrow, or other similar device may be used for this purpose. Such loosening will be required to ensure bond of the topsoil with the surface on which it is put and to form a uniform surface. The topsoil shall then be spread to a sufficient depth to produce the thickness specified after it has been compacted lightly with an approved roller, tamping device, or other method.

40

For temporary seeding, the seed bed, if not loose, shall be scarified. The area to be temporary seeded need not be made smooth and uniform.

621.04 Preparation of Ground Before Applying Erosion Control Blankets

Prior to placing the blankets, the area to be covered shall be relatively free of all rocks or clods over 1.5 in. (38 mm) in diameter, and all sticks or other foreign material, which prevent the close contact of the blanket with the seed bed. If as a result of a rain, prepared seed bed becomes crusted or eroded, or if eroded places, ruts, or depressions exist, the soil shall be reworked until it is smooth. Such areas which are reworked shall be re-seeded.

621.05 Applying Fertilizer, Seed, and Mulch

(a) Fertilizer

Fertilizer as specified shall be spread uniformly over the area to be seeded. Fertilizer shall be spread at the rate of 800 lb/acre (900 kg/ha) unless otherwise specified.

(b) Seed

Seed may be drilled in or mixed with water. The mixture shall be sprayed over the area to be seeded. An approved mechanical method which shall place the seed in direct contact with the soil may be used. In places inaccessible to mechanical equipment, or where the area to be seeded is small, a hand operated cyclone seeder or other approved equipment may be used. Seed of warm season grasses, forbs, or aquatic species shall not be covered more than 0.125 in. (3 mm). All other seed shall not be covered more than 0.5 in. (13 mm).

Leguminous seeds, unless otherwise specified, shall be inoculated with a culture in accordance with 914.06. The culture shall be mixed with sufficient water to distribute it thoroughly. The seed shall be wetted thoroughly with the solution and allowed to dry sufficiently to be in condition for sowing. Inoculated seed shall be sown within 30 h after treatment. Where seeding is to be done by hydraulic methods, the inoculate may be added to the water in the spray tank.

(c) Mulch

Mulching material, when specified, shall be applied uniformly in a continuous blanket at the rate of 2 tons/acre (4.5 Mg/ha). Mulch shall be placed within 24 h after seeding. The percent of moisture in the mulch shall be determined in accordance with 621.14(c).

Mulching material shall be punched into the soil so that it is partially covered. The punching operation shall be performed longitudinally with the mulch tiller. The tools used for punching purposes shall be disks that are notched and have a minimum diameter of 16 in. (400 mm). The disks shall be flat or uncupped such as notched coulters commonly used on moldboard plows. Disks shall be placed a minimum of 8 in. (200 mm) apart along the axle or shaft. Shaft or axle sections of disks shall not exceed 8 ft (2.5 m) in length.

The mulch tiller for punching shall be constructed so that weight may be added or hydraulic force from the tractor may push the puncher into the ground. If heavy weights are not used, several trips over the area may be necessary to work part of the mulch into the soil. Care shall be exercised to obtain a reasonably even distribution of mulch incorporated into the soil.

After procedures for holding the mulch in place have been completed, mulch, other than when applied by hydroseeder, shall be watered thoroughly. The seed or soil beneath it shall not be displaced. The mulching material shall be maintained in place satisfactorily until final completion and acceptance of the contract except as provided in 107.18. When seeding is performed between June 1 and August 15, a second thorough watering shall be applied approximately 21 days after seeding.

On slopes steeper than 3:1, or when specified, the following methods will be permitted.

1. Method A

The mulch may be held in place by means of a commercially produced mulch binder which is in accordance with all applicable State and Federal regulations. Such product shall be applied in accordance with the manufacturer's written instructions. A copy of the written instructions shall be supplied to the Engineer prior to the seeding work. The product shall contain a coverage indicator to facilitate visual inspection for evenness of application. If the mulch fails to stay in place, the Contractor shall repair all damaged areas. A change in the mulch binder may be requested by the Engineer.

2. Method B

The mulch may be held in place by spraying it with a satisfactory liquid asphalt or asphalt emulsion. The bituminous material may be applied immediately after the mulch is in place or it may be injected into the mulch as it leaves a power driven mulch spreader. If applied to the surface, the amount shall be approximately 0.06 gal./sq yd (0.25 L/m²). If applied as the mulch comes from the spreader, the amount shall be approximately 60 gal./ton (0.25 L/kg) of mulch material. The exact amount shall be as directed.

3. Method C

The mulch may be held in place with binder twine fastened down with wooden pegs not less than 6 in. (150 mm) long spaced 4 ft (1.2 m) apart. The twine shall be placed parallel to and also at 60° with the pavement edge in both directions. The distance between the intersections of the diagonal strands measured along the strands shall be 12 ft (3.7 m). The strand parallel to the pavement shall cross the diagonal strands at their intersections to form equilateral triangles 12 ft (3.7 m) on a side.

4. Method D

The mulch may be held in place with a polymeric plastic net. The plastic net shall be unrolled such that it lays out flat, evenly, and smoothly, without stretching

the material. The plastic net shall be held in place by means of wire staples. The wire staples shall be driven at a 90° angle to the plane of the soil slope. Staples shall be spaced not more than 4 ft (1.2 m) apart with rows alternately spaced. The plastic net shall be secured along the top and bottom of the soil slope with staples spaced not more than 1 ft (0.3 m) on center. The ends and edges of the plastic net shall be overlapped approximately 4 in. (100 mm) and stapled. Overlaps running parallel to the slope shall be stapled 1 ft (0.3 m) on center and overlaps running perpendicular to the slope shall be stapled at least 3 ft (0.9 m) on center. The plastic net shall be placed with the length running from top of slope to toe of slope, or the plastic net shall be placed with the length running horizontally or parallel to the contour.

5. Method E

The area may be covered with erosion control blankets. The Contractor will be permitted to use excelsior blanket, paper mat, or straw mat.

(d) Excelsior Blankets

Excelsior blankets may be used where mulched seeding is specified or where erosion control blanket is specified. Excelsior blankets shall be placed within 24 h after seeding operations have been completed. The ground shall be prepared in accordance with 621.04. After the area has been properly shaped, fertilized, and seeded, the blanket shall be laid out flat, evenly, and smoothly, without stretching the material. Excelsior blankets shall be held in place by means of wire staples. The staples shall be driven at a 90° angle to the plane of the soil slope. Staples shall be spaced not more than 5 ft (1.5 m) apart in three rows for each strip, with a row along each edge and one row alternately spaced in the middle. The upslope edge shall be fastened by staples spaced 12 in. (300 mm) apart. The ends and edges of the blankets shall be tightly butted together, but not lapped. When excelsior blanket is used, the blanket shall be placed with the length running from top of slope to toe of slope, or the blanket shall be placed with the length running horizontally or parallel to the contour. The staples used for stapling shall be in accordance with 914.09(f).

(e) Paper Mat

Paper mat may be used for mulch for seeding where mulched seeding is specified or where erosion control blanket is specified. Paper mat shall be placed within 24 h after seeding operations have been completed. The ground shall be prepared in accordance with 621.04.

After the area has been properly shaped, fertilized, and seeded, two anchor trenches shall be dug, one along the foot of the slope and the other 1 ft (0.3 m) back from the crown of the slope. These anchor trenches shall be 4 in. (100 mm) deep and at least 6 in. (150 mm) wide. One edge of the paper mat shall be placed into the top trench and stapled 9 in. (230 mm) on center. The trench shall then be filled with soil. The paper mat shall then be unrolled such that it lays out flat, evenly, and smoothly, without stretching the material. Paper mat shall be held in place by means of wire staples. The staples shall be driven at a 90° angle to the plane of the soil slope. Staples shall be placed not more than 3 ft (1.0 m) apart with rows alternately spaced.

621.05

The paper mat shall be secured in the bottom anchor trench in the same manner as it was secured in the upper anchor trench. The ends and edges of the mat shall be overlapped at least 4 in. (100 mm) and stapled.

190 Overlaps running parallel to the slope shall be stapled 18 in. (460 mm) on center and overlaps running perpendicular to the slope shall be stapled at least 9 in. (230 mm) on center. When paper mat is used, the mat shall be placed with the length running from top of slope to toe of slope, or the mat shall be placed with the length running horizontally or parallel to the contour.

(f) Straw Mat

200 Straw mat may be used for mulch for seeding on projects where mulched seeding is specified or where erosion control blanket is specified. Straw mat shall be placed within 24 h after seeding. The ground shall be prepared in accordance with 621.04. After the area has been properly shaped, fertilized, and seeded, the straw mat shall be unrolled over the designated area so that the plastic mesh is on top and the straw fibers are snugly and uniformly in contact with the soil surface without stretching the material. The rolls shall be butted snugly together and stapled in place. The staples shall be driven through the blanket at a 90° angle to the plane of the ground surface. Each staple shall anchor the plastic mesh. The staples shall be spaced at approximately 3 ft (1.0 m) increments, both longitudinally and transversely.

210 For placement on slopes, the straw mat shall be placed with the length running from the top of slope to the toe of slope and shall extend a minimum of 3 ft (0.9 m) over the crown of the slope. On slope applications, six staples shall be installed across the uphill end of the roll. The downhill ends of the lowermost rolls across the slope shall also be anchored with six staples, placed on uniform spacing.

For placement in ditch lines, the straw mat shall be unrolled parallel to the centerline of the ditch. The mat shall be placed so that there are no longitudinal seams within 24 in. (600 mm) of the bottom centerline of the ditch. In ditch lines, six staples shall be placed at uniform spacing across the upstream end of each roll.

(g) Wood Cellulose Fiber Mulch

220 Wood cellulose fiber may be used where mulched seeding is specified. Wood cellulose fiber mulch shall be placed at the rate of 1 ton/acre (2200 kg/ha) within 24 h after seeding operations have been completed. Application shall be by hydraulic mulching and consist of mixing wood cellulose fiber mulch and grass seed with water. It shall be mixed in standard hydraulic mulching equipment to form a homogeneous slurry. The slurry shall be sprayed, under pressure, uniformly over the soil surface. The hydraulic mulching equipment shall contain a continuous agitation system that keeps all materials in uniform suspension throughout the mixing and distribution cycles. Fertilizer shall be applied in accordance with 621.05(a).

621.06 Seed Mixtures

Seed mixtures shall be classified as follows. Mixes including warm season grasses, forbs, or aquatic species will be specified in the plans.

230

(a) Seed Mixture R

This seed mixture shall be applied at the rate of 170 lb/acre (190 kg/ha). The mixture shall consist of 95 lb (43 kg) of low endophyte Kentucky 31 Fescue or approved equal, 65 lb (30 kg) perennial ryegrass, and 10 lb (4.5 kg) Jasper Red Fescue or approved equal. Fertilizer and mulching material, where specified or directed, shall be applied in accordance with 621.05.

(b) Seed Mixture U

240 This seed mixture shall be applied at the rate of 150 lb/acre (165 kg/ha). The mixture shall consist of 95 lb (43 kg) of a 4-way blend of turf type tall fescues such as Tribute, Rebel II, Trailblazer, or approved equal; 20 lb (9 kg) Jasper Red Fescue or approved equal; and 35 lb (16 kg) certified fine bladed perennial ryegrass such as Regal, Blazer, or approved equal. Fertilizer and mulching material, where specified or directed, shall be applied in accordance with 621.05.

(c) Seed Mixture P

250 This seed mixture shall be applied at the rate of 80 lb/acre (90 kg/ha). The mixture shall consist of 30 lb (14 kg) of "Fulfs" Puccinella Distans, 30 lb (14 kg) of Jasper Red Fescue, or approved equal, and 20 lb (9 kg) of perennial ryegrass. Fertilizer shall be applied at the rate of 400 lb/acre (450 kg/ha). Fertilizer and mulching material, where specified or directed, shall be applied in accordance with 621.05.

(d) Blank

(e) Seed Mixture D

260 This seed mixture is intended for ditch situations which experience seasonal to chronic saturated soils. This seed mixture shall be used on maintenance contracts or where otherwise specified. This mixture shall be applied at the rate of 14 lb 12 oz per acre (16.5 kg/ha). The mix shall be composed of 1 oz (28 g) Fowl Mana Grass, 3 oz (85 g) wetland Carex species, 2 oz (56 g) Rice Cut Grass, 2 oz (56 g) Bullrush, 2 oz (56 g) Leptochloa fascicularis, 2 oz (56 g) Barnyard Grass, 2 oz (56 g) Prairie Wild Rye, 10 lb (4.5 kg) perennial ryegrass, 2 lb (1 kg) Jasper Red Fescue, 2 oz (56 g) "Fulfs" Puccinella Distans, and 1 lb (0.5 kg) Redtop. If certain species in this mix are unavailable, substitutions may be submitted for approval. The mix shall be applied as specified per acre (hectare). The method of planting shall be by means of hydroseeding or by means of a hand method with a minimal amount of mulch applied in a separate operation. Fertilizer shall not be added to this seed mixture.

270

(f) Seed Mixture T

This seed mixture shall be used to establish a temporary cover for disturbed soil during the construction operations. Seed mixture T shall be used for soil stabilization

621.06

and temporary ground cover. Temporary cover mixtures shall be placed as directed and be subject to seasonal limitations as defined herein. This mixture is not intended to be used as a permanent seed mixture. The mix shall be mulched in accordance with 621.05(c) when slopes exceed 3:1. From December 1 to March 14 and from June 16 to August 31, mulching alone shall be used to stabilize the soil. This mixture shall not be used to satisfy the requirements of the warranty bond.

280

1. Spring Mix

Spring mix shall be used from March 15 through June 15. This mixture shall be applied at the rate of 150 lb/acre (165 kg/ha). The mix shall consist of oats.

2. Fall Mix

Fall mix shall be used from September 1 through November 30. This mixture shall be applied at the rate of 150 lb/acre (165 kg/ha). This mix shall consist of winter wheat.

(g) Seed Mixture Grass

290

This seed mixture shall be placed when specified as shown below.

1. Type 1

This seed mixture shall be placed at the rate of 195 lb/acre (220 kg/ha). The mixture shall consist of 15 lb (7 kg) of Smooth Brome grass, 10 lb (4.5 kg) of Orchardgrass, and the mixture specified in 621.06(a).

2. Type 2

300 This seed mixture shall be placed at the rate of 110 lb/acre (124 kg/ha). The mixture shall consist of 15 lb (7 kg) of Smooth Brome grass, 10 lb (4.5 kg) of Orchardgrass, 40 lb (18 kg) of Certified Common Kentucky Bluegrass, 30 lb (14 kg) of Creeping Red Fescue, and 15 lb (7 kg) of Perennial Rye Grass.

(h) Seed Mixture Legume

This seed mixture shall be placed when specified as shown below. Mulched seeding, when specified, shall be in accordance with 621.07.

1. Type 1

310 This seed mixture shall be placed at the rate of 190 lb/acre (214 kg/ha). The mixture shall consist of 10 lb (4.5 kg) of Sericea Lespedeza or Korean Lespedeza, 10 lb (4.5 kg) of medium Red Clover or Alsike Clover, and the mixture specified in 621.06(a).

2. Type 2

This seed mixture shall be placed at the rate of 100 lb/acre (112 kg/ha). The mixture shall consist of 10 lb (4.5 kg) of Sericea Lespedeza or Korean Lespedeza, 10 lb (4.5 kg) of medium Red Clover or Alsike Clover, 10 lb (4.5 kg) of Birdsfoot Trefoil, 40 lb (18 kg) of Certified Kentucky Bluegrass, 30 lb (14 kg) of Creeping Red Fescue, and 10 lb (4.5 kg) of Annual Rye Grass.

- 320 “Do Not Spray” signs shall be placed near the beginning and end of this work, at 200 ft (60 m) intervals, or as otherwise directed. The sign shall be 16 gage (1.6 mm) aluminum. The size and message arrangement shall be as shown on the plans. The sign background shall be white. The sign lettering shall be black. The sign shall not be reflectorized. Paint and primer shall be in accordance with 909.04. The sign post shall be placed as shown on the plans. The post shall otherwise be in accordance with 910.15.

621.07 Mulched Seeding

- 330 Mulched seeding, when specified, shall consist of applying the seed mixtures in accordance with 621.06(a), 621.06(b), and 621.06(c) as specified. This mixture shall include fertilizer and mulching material in the amounts set out herein. If erosion control blanket is specified, the Contractor will be permitted to use excelsior blanket, paper mat, or straw mat in accordance with 621.05(d), 621.05(e), or 621.05(f), respectively.

621.08 Preparation of Ground Before Sodding

- 340 The area to be sodded shall be smooth, uniform, and shall be in accordance with the required cross section. Surfaces prepared for sod shall be of sufficient depth below unseated areas that newly laid sod shall be in accordance with the surrounding surface.

For those areas which shall be covered with topsoil, the procedure for the application of topsoil shall be in accordance with 621.03.

After the area has been prepared for sod, fertilizer shall be applied at the rate of 400 lb/acre (450 kg/ha). The surface shall be loosened to a depth of 1 to 2 in. (25 to 50 mm) and then raked before the sod is placed. All clods, lumps, boulders, or waste material shall be removed satisfactorily.

- 350 In areas where the above method of preparation is impracticable, a different method may be approved.

621.09 Laying Sod

- 360 Sod strips shall be laid in the designated direction. The sod shall be fitted to the surrounding grade and fixed objects. The sod strips shall be butted together closely to avoid open joints. Overlapping of sod will not be permitted. After laying and initial watering, the sod shall be tamped or rolled as directed to ensure contact with the soil underneath and shall be in accordance with the surrounding surface. After compaction, the sod shall present a smooth even surface free from lumps and depressions. On slopes of 3:1 or flatter, the use of broken sod strips will be permitted. Where broken pieces are laid, no overlaps will be allowed.

Sod placed in ditches with grades steeper than 1% and on slopes 3:1 and steeper shall be pegged. The pegs shall be spaced not over 2 ft (610 mm) apart in each strip

621.10

measured lengthwise of the strip. Pegs shall be driven down until no more than 1 in. (25 mm) protrudes above the surface of the sod. Grades and slopes flatter than specified herein shall be pegged as directed.

370 Pegs shall be wood at least 0.5 in. by 0.75 in. by 12 in. (13 mm by 19 mm by 300 mm). In lieu of pegs, T-shaped wire pins may be used. The pins shall be machine bent from 8 gage (4 mm) low carbon steel with a minimum of a 8 in. (200 mm) leg, a 4 in. (100 mm) head, and a 1 in. (25 mm) secondary drive. Pins shall be driven flush with the top of the sod.

621.10 Watering Sod

380 Sod shall be watered immediately after laying. The amount of watering shall be sufficient to saturate the sod and the upper few inches (millimeters) of the underlying soil. The sod shall be watered once every day of the first week, once every second day of the second week, once every third day of the third week, and once a week thereafter. Sod shall be maintained for a minimum of four weeks from the time it is laid before being accepted. During periods of ample rainfall, watering may be modified to simulate the above schedule. The requirements of 107.18 shall apply.

621.11 Seeding or Sodding Disturbed Areas Outside Construction Limits

390 Areas outside shown construction limits which are disturbed by the Contractor shall be repaired to their original condition or better. The areas shall be seeded with a seed mixture grass type 2 in accordance with 621.06(g)2 or seed mixture legume type 2 in accordance with 621.06(h)2 as directed. If the contract contains seed mixtures other than the two listed here, the Contractor may seed the disturbed area with the mixture contained in the contract provided the area is less than 1 acre (0.5 ha) in size. If the area disturbed is well maintained and part of a residential or commercial lot, it shall be sodded unless the Engineer determines otherwise.

621.12 Seasonal Limitations

The Contractor shall post a warranty bond for all permanent seeding done from October 16 through January 31. Only completed seeding with seed mixtures R, U, or P shall satisfy the requirements of the warranty bond. Seeding without mulch shall not be done between May 1 and August 15.

400 Sod placed during the months of June, July, and August shall be subject to the following conditions.

- (a) sod shall be in good, live, growing condition; and
- (b) sod shall be placed within 36 h after cutting and protected from damage during that period.

410 Winter sodding will be permitted when the temperature is above 35°F (2°C). No frozen sod shall be laid and no sod shall be laid on frozen soil. Sod shall be properly protected from drying out and shall be laid within 48 h after cutting.

The cost of leguminous inoculants, preparing seed beds, sowing, raking, and all other necessary incidentals shall be included in the cost of seed mixtures. The cost of
 460 furnishing and placing fertilizer, seed mixtures, and mulching material, in addition to the incidentals listed above for seed mixtures shall be included in the cost of mulched seeding.

The cost of furnishing, hauling, and placing the material, including material used as tie-down, repair of areas for which mulch fails to stay in place, all labor, equipment, and necessary incidentals shall be included in the cost of mulching material.

Repair of areas outside the construction limits which must be disturbed to
 470 construct the work required by the contract will be paid for in accordance with 201.07(e).

Water will be paid for only when ordered after the 30 day period, in accordance with 621.10.

Payment will not be made for topsoil which is obtained from within the right-of-way.

The cost of fertilizer, water, excavation of earth bed, disposal of surplus
 480 material, and all necessary incidentals shall be included in the cost of sodding or nursery sodding.

(a) Warranty Bond

Permanent seeding that requires a warranty bond to meet the requirements of 621.12 shall be warranted against failure resulting from lack of germination or method of application. The seeding shall be warranted to germinate and shall be free of obvious erosion occurrences. The intent of the warranty bond shall be to permit the final acceptance of the contract and payment of the retainage. All seeding which
 490 has significantly failed to attain approximately 60% germination shall be replaced with no additional payment. A properly executed maintenance bond with a surety shall be provided prior to the completion of the work. A warranty shall be made, with no additional payment, to replace all seeding in areas which has not effectively performed useful service as specified, as well as for the repair of designated erosion areas caused by seeding failure. Such warranty shall be in writing with proper execution of the maintenance bond with a proper surety. The warranty shall be equivalent to 1 1/2 times the cost of the seeding work completed after October 15 with a minimum bond amount of \$25,000. All requirements for seeding work will still apply during the warranty period unless otherwise directed.

500 For the terms of the warranty, a reseeding unit shall be defined as an area equal to or larger than 2,000 sq ft (185 m²) in size. An erosion unit may be of an area of significance as determined.

The warranty shall cover work completed from October 16 through January 31. The Department will determine if the Contractor shall be released from the warranty. This determination will be made within 10 calendar days after documented request for inspection is made by the Contractor. Such determination will not be made prior to April 1. All replacement work shall be finished prior to June 15 with no additional payment. The requirements of 107.17 will apply to the warranty area only. The
 510 Engineer will certify in writing as to the completion of the work and will make proper notification for the releasing of the bond.

If the Contractor does not complete the necessary repairs before June 15, and there are no justifiable reasons for the Department to grant an extension, the Contractor shall forfeit the bond for the seeding work only. If a bond is forfeited, the Contractor will be required to explain to the Department why the Contractor's experience reduction factors do not warrant an increase.

(b) Changed Fertilizer

520 A fertilizer may be required with a higher nitrogen content than that specified, or the fertilizer specified may be required to be enriched by adding chemicals in order to be in accordance with such requirements. All additional cost incurred due to such procedure will be paid at the prices shown by certified vouchers. Such payment will include and will be full compensation for furnishing the required chemicals, or furnishing and processing the additional materials required.

(c) Mulching

The percent of moisture shall be determined at the time the mulching material is weighed. Facilities shall be provided for weighing in accordance with 109.01(b).
 530 Arrangements shall be made in advance so that the percent of moisture will be determined at the time of weighing and that the weight (mass) of the material will be checked. Moisture content of the mulch will be determined on the basis of air dry weight as follows:

$$\text{Moisture Content \%} = \frac{\text{Wet Weight (Mass) of sample} - \text{Air Dry Weight (Mass) of sample}}{\text{Air Dry Weight (Mass) of Sample}} \times 100$$

540 The gross, or wet, weight (mass) of mulching material furnished and placed will be paid for if the moisture content does not exceed 10%. If the moisture content exceeds 10%, the weight (mass) to be paid for will be the gross, or wet, weight (mass) minus the weight (mass) of excess moisture computed as follows:

622.01

$$\text{Weight (Mass) to be paid for} = G \times \frac{110}{(100 + M)}$$

- 550 G = Gross, or wet, weight (mass) of mulching material
 M = Moisture content, percent, in the mulching material to the nearest 0.5%

Mulching material which contains more than 50% moisture will be rejected.
Wood cellulose fiber mulch containing more than 15% moisture will be rejected.

SECTION 622 – PLANTING TREES, SHRUBS, AND VINES

622.01 Description

This work shall consist of furnishing, delivering, and planting trees, shrubs, and vines, and also seedlings for wildlife habitat. This work shall also consist of the performance of incidental planting procedures and plant establishment work to provide a complete operation in accordance with 105.03.

MATERIALS

10

622.02 Materials

Materials shall be in accordance with the following:

	Backfill Material.....	914.01
	Fertilizer	914.03
	Mulch	914.05(b)
	Pipe.....	914.09(e)
	Plants	914.08
	Porous Material	914.09(d)
20	Tree Wound Dressing.....	914.09(c)
	Water	914.09(a)

Soil conditioners such as peat moss or calcine clay may be added with written permission.

Guy wire shall be minimum No. 14 gage (2.0 mm) galvanized wire.

CONSTRUCTION REQUIREMENTS

30 622.03 Care and Handling of Plants

(a) Bare Rooted Plants

If the outside air temperature exceeds 35°F (2°C) when the plants are delivered, the plants shall be planted immediately or placed in inside or outside storage. If they are stored outside, the roots shall first be puddled in a paste solution of backfill and

water. The plants shall then be separated and their root systems heeled-in by completely covering with moist soil. If they are stored inside, the roots shall be puddled in a paste solution of backfill and water. Straw, peat moss, or corncobs shall be worked in and around the root system and kept moist. Plants which are delivered
 40 in boxes, wrapped bundles, or other forms of closed containers, including trucks, and which are stored inside may remain in the container for 48 h from time of delivery, provided the containers are opened immediately and the plants are watered if necessary.

If the outside temperature is 35°F (2°C) or less when plants are delivered, the plants shall be placed in inside storage immediately. Inside storage procedures shall be in accordance with the above requirements. Plants may be transferred to outside storage when the outside temperature exceeds 35°F (2°C) provided they are puddled again and then heeled-in.

50

Temperature inside the storage building shall be maintained between 35°F (2°C) and 55°F (13°C). Plants shall not remain in storage, either inside or outside, for more than seven days, unless otherwise permitted because of unfavorable planting conditions.

Plants may be rejected on failure to comply with these specifications.

(b) Balled and Burlapped Plants and Container Grown Plants

Plants shall be planted or placed in storage before being exposed for 10
 60 consecutive hours at temperatures less than 35°F (2°C). Storage of plants shall be in a moist storage building or they shall be placed outside in a compact group with balls or containers completely covered with corncobs and kept moist. Plants shall not remain in storage for more than 10 days, unless otherwise permitted because of unfavorable planting conditions.

Plants may be rejected on failure to comply with these specifications.

622.04 Collected Plants

At least 24 h before starting to dig collected plants, notification shall be given of
 70 the time and place of digging so inspection of the work and of the plants can be made, if so desired.

Collected plants shall be dug carefully in a satisfactory manner. All operations of digging, transporting, and replanting collected plants shall be in accordance with all applicable laws and regulations of the state.

622.05 Excavation for Plant Holes

Stakes will be set to locate plant holes for each tree, shrub, or vine. The outline of each seeding bed will be staked and the planting on the required centers shall be
 80 as directed. Stakes for the staking operation shall be furnished. The location stakes shall be removed as directed. Excavation shall be such that the plant holes are

cylindrical in shape with the sides approximately vertical. Material excavated from the holes may be used for backfill providing it is in accordance with 914.01. Otherwise, it shall be distributed uniformly within the construction area as directed. The excavated material shall not be stockpiled on turf or in ditches. Material unsuitable for the growth of vegetation, including rocks and boulders, shall be disposed of outside the right-of-way as directed and in accordance with 203.01 and 203.10. Plant holes shall be in accordance with the details and tables shown on the plans. If plants have not been planted within 10 days after excavation of the hole, the hole shall be refilled and re-excavated at the time of planting. No additional payment will be made for this operation.

If, after staking or excavation of the plant holes at the locations shown on the plans, it becomes apparent that the location is unsuitable for planting due to accumulation of ground water, possible flooding because of terrain conditions, or unsuitable soil conditions, plant holes shall be relocated as directed. Such relocation shall be done with no additional payment.

622.06 Planting Season

The planting season shall be from September 1 through the following May 25, with the exception that trees shall be planted from October 1 through the following April 15, provided that trees are dormant. Crown vetch plants and seedlings shall be planted only from April 15 through May 30, unless approved in writing. Bare rooted plants shall be planted only when the outside air temperature exceeds 35°F (2°C). Unless otherwise approved, deciduous plants, except those container grown, shall be dormant at the time they arrive at the work or storage site. Evergreens shall not have active terminal growth. At least 40% of the total number of balled and burlapped, and container grown plants, not including crown vetch plants, shall be planted from the beginning of the planting season through December 31. Bare root seedlings for wildlife habitat shall be planted from October 1 through the following April 30. Container grown seedlings for wildlife habitat shall be planted at any time.

The initial planting and spring replacements, in accordance with 622.18, shall be completed satisfactorily within the planting season which expires prior to the completion date of the contract. These plants shall have an establishment period which shall be from the end of the specified planting period to the fall inspection. If the initial planting and spring replacements are not completed within the specified time, the completion date may be extended one year to provide an establishment period. If the completion date is extended, all requirements of 622.18 shall apply until final inspection and acceptance.

622.07 Pruning

Before the plant is placed in the plant hole, any bruised or broken parts of roots shall be cut off smoothly as approved unless otherwise specified or directed. All plants shall be pruned either before or after planting. Such pruning generally shall consist of thinning out or cutting back secondary branching to reduce the foliage by 1/3 to 1/2 in accordance with accepted horticultural practices. Pruning operations

shall maintain the general crown outline and characteristic branching pattern for each species. Pruning or cutting back of terminal leaders which are over 3/8 in. (10 mm) in diameter at the point of cut will not be permitted. Broken or dead branches, or any other objectionable parts of the plant, shall be removed throughout the life of the contract. Pruning tools shall be kept sharp and shall be sterilized in denatured alcohol after each hour of use. All cut surfaces 3/8 in. (10 mm) or more in diameter shall be painted with a tree wound dressing.

Bare rooted shrubs shall be cut back to 1/2 their minimum specified height as shown on the plans. Pruning shall be performed after the shrubs have been sealed with Department seals and prior to the leaf buds breaking dormancy. At the time of the spring and fall inspections, bare rooted shrubs will be accepted at their original specified height provided they are healthy, in good growing condition, and are no less than 1/2 the minimum specified height.

622.08 Planting, Backfilling, and Watering

The plant shall be placed in the plant hole at the proper position for depth, alignment, final grade of the surrounding ground level, and vertical position of the trunk. The planting procedure shall be performed in such a manner that the top of the ball of the plant is as shown on the plans at the time of planting. The planting procedure shall be in accordance with the details as shown on the plans. Backfill material in accordance with 914.01 shall be placed around all plants except seedlings. The quantities of backfill material required per plant shall be as shown on the plans.

In areas which are designated on the plans as beds for group planting, the soil shall be tilled to a minimum depth of 6 in. (150 mm) in such a manner that all sod and vegetation is destroyed. These areas shall be tilled at least two times with an interval of 14 days between tilling operations. Planting may be done immediately after the second tilling. Additional tilling shall be performed if vegetation appears before mulch is applied. Sod and vegetation shall be removed in lieu of the tilling operation when the soil temperature or moisture conditions are such that the sod and vegetation would not be destroyed by tilling. At other times, sod and vegetation may be removed in lieu of tilling. If the excavation resulting from sod removal is greater than 1 in. (25 mm) deep, it shall be backfilled with topsoil to 1 in. (25 mm) above the original ground. After sod and vegetation removal and backfilling, the bed area shall be cultivated to a depth of 6 in. (150 mm). Large clods, rocks, and other debris encountered in the cultivation work and any excess soil shall be removed. The outline of beds for group plantings shall be no closer than 3 ft (1.0 m) to the center of any of the outer plants in the area.

In addition to the water applied at the time of planting, unless excessive moisture prevails, the minimum supplemental waterings required shall be two between May 1 and June 15, and one every 14 days between June 15 and September 15. Sufficient water shall be applied to individual plants to saturate the backfill and the mulch area. Plants in beds shall receive water equivalent to the quantity used for

individual plants. Liquid fertilizer, in accordance with 622.09, may be applied with the supplemental watering and the method of application shall be approved. Lance watering will not be permitted.

- Container grown seedlings for wildlife habitat which have been planted from June 1 through August 31 shall be maintained after installation for 30 days.
- 180 Maintenance shall include watering the seedlings at the time of planting and once every seven days.

(a) Plants with Bare Roots

- With the plant in its proper position, the plant hole shall be backfilled with material in accordance with 914.01. The backfill material shall be worked firmly around the roots as the hole is gradually filled. The plant shall be raised gently and lowered slightly as the soil is added to help eliminate air pockets around the roots. Soil shall be added in layers of about 6 in. (150 mm) and each layer tamped to make it firm and to hold the plant perpendicular. Water shall be used to settle the soil and
- 190 to eliminate air pockets around the roots, unless otherwise directed. The top 4 in. (100 mm) of soil necessary to fill the plant hole completely shall be a very fine mixture and shall be placed on top of the firmed backfill and allowed to remain loose and untamped.

(b) Balled and Burlapped Plants

- Balled and burlapped plants shall be handled by the ball and placed in the holes in such a manner that the soil of the ball does not become loosened from the roots. The soil directly beneath the ball shall be firmed to minimize settling. Guy stakes shall be driven before backfilling operations begin. After the hole has been partially
- 200 backfilled and the material firmed under and around the ball, the burlap shall be cut away and removed from the stem of the plant. Backfilling and firming shall then be completed in a manner to avoid loosening the soil from the root ball. Watering shall be done in accordance with 622.08(a). Backfill material shall be in accordance with 914.01.

(c) Seedlings for Wildlife Habitat

- Seedlings shall be from 6 to 18 in. (150 to 450 mm) in height. Seedlings shall be planted as directed in the locations shown on the plans. Species shall be selected from the list as shown on the plans. Alternate species selection shall be subject to
- 210 approval. Seedlings shall be planted no closer to each other than the distance shown on the plans. Seedlings shall not be planted in rows, but instead shall be planted in a natural appearing pattern. Failure to comply with this procedure will require the replanting of the seedlings as directed with no additional payment. All damaged seedlings shall be replaced with no additional payment if replanting is required.

622.09 Liquid Fertilizer Application

All plants shall be fertilized with a water soluble 5-10-10 fertilizer, or an equivalent amount of plant nutrients, at the rate of 0.75 lb/100 gal. (0.36 kg/400 L) of water. Fertilizer shall be applied to each installed plant until the mulched area over

- 220 the plant hole is saturated. Three applications shall be made: one on or about July 1; one about August 1; and one about September 1.

622.10 Mulching

Mulch, in accordance with 914.05(b), shall be placed as a top layer around each plant as soon as it has been installed. The mulch shall cover the entire area as described in 622.08 and shall be placed around individual plants in accordance with the plans.

622.11 Guying and Staking

- 230 Guying and staking shall be in accordance with the details shown on the plans. Guy wire shall be placed through rubber hose material around each tree then twisted to secure the tree in a relatively stable position. Three wood stakes shall be spaced equally about each tree. The guy wire shall be secured to each stake at an approximately right angle. Support of multi-stem trees of 4 to 6 ft (1.2 to 1.8 m) in height shall consist of inner limb guying and bracing stakes. The securement point and placement of guy wire shall be so as to avoid abrasion of tree limbs. The guys and stakes shall be maintained for the duration of the contract. Prior to final inspection, all materials used to support trees shall be removed and disposed of, except as otherwise directed for trees requiring additional bracing time. However,
- 240 supports for fall replacement shall remain in place. If approved, stakes may be left flush with the ground.

622.12 Plant Protection

(a) Borer Control Coatings

- Within five days after planting and prior to wrapping, all trees, except evergreens, shall be protected against borer attack with an insecticide mixture applied to the tree trunk with a paint brush or a suitable hand sprayer. The application shall cover the trunk from the root crown to the first major branches. The
- 250 mixture shall consist of enough powdered skim milk to form a smooth slurry when added to either dieldrin 18 at the rate of 2 qt to 50 gal. (1 L to 100 L) of water or thiodan 50 at the rate of 1 lb to 50 gal. (1 kg to 420 L) of water.

(b) Wrapping for Rodent Protection

- Within seven days after planting, all crabapple and shade trees with a 0.5 in. (13 mm) diameter or larger, except for multi-stem forms, shall be wrapped with a double layer of 18 by 14 wires per in.² (71 by 55 wires per 10,000 mm²) aluminum mill finish screen wire mesh around the trunk of each tree as shown on the plans. The height of screen wire shall be from the existing grade to below the lowest branch.
- 260 The screen wire shall be overlapped at the ends. The screen wire shall be secured to itself with hog rings or other approved methods, and to the rods by approved means.

Plastic coil type protective wrapping will be acceptable as an alternative to the screen wire and reinforcement rod method of tree protection or staked trees of less than 2 in. (50 mm) caliper. The wrapping shall be loosened twice each calendar year.

The first adjustment shall be made between May 15 and June 15. The second adjustment shall be made between September 1 and September 30. The plastic tree protective wrapping shall extend to the height of the bottom limb.

- 270 The Contractor may submit other proposed methods of rodent protection to the Department's landscape architect for approval prior to installation. The design of the protection shall ensure an average air space diameter of 2 in. (50 mm) greater than the tree's calipered size at installation. The protection shall permit air movement through its surface to dry the tree trunk following periods of precipitation. The protection shall not damage the tree nor hinder its growth.

- 280 Multi-stem trees shall be wrapped with commercially available wrapping paper wrapped tightly around the trunks from the ground to the lowest branch with a minimum of 0.5 in. (13 mm) overlap. The wrapping paper shall be tied securely with stout cord at top and bottom and at two intermediate intervals.

622.13 Retaining Walls and Tree Wells

- Retaining walls around the roots of trees or shrubs, and tree wells around the trunks of trees or shrubs shall be constructed at the locations and to the shape and dimensions shown on the plans or as otherwise designated. They shall be of mortar and masonry, or other type as specified. Mortar shall not be used in any portion of the tree well extending below the top of contiguous porous material used for tree root protection. The inside face of a tree well shall be no less than 2 ft (0.6 m) from the outside edge of the trunk of the tree or shrub. No material shall be placed between
290 the tree trunk and the wall of the tree well.

622.14 Tree Root Protection

- Where tree root protection is specified, the entire area of the root spread shall be protected. The limits of this area shall be as designated, but in general this area corresponds to the area of the ground surface lying beneath the limb spread of the tree. The area shall be cleaned of all vegetation and debris. Porous material, in accordance with 914.09(d), shall be placed uniformly over the area to a depth in proportion to the height of fill, varying proportionally from 3 in. (75 mm) for fills of 1 ft (300 mm) or less to 12 in. (300 mm) for fills of 4 ft (1.2 m) or more, or to such
300 other depth as may be designated. A layer of No. 23 sand or other approved material shall then be placed in sufficient quantity to choke the top layer of porous material and will be measured and paid for as porous material.

Where the earth fill is less than 12 in. (300 mm) and tree root protection is specified without the construction of a tree well, the thickness of the porous material at the tree trunk shall be increased to the height of the fill and extend outward from the tree trunk in collar form for a distance of 12 in. (300 mm), unless otherwise shown on the plans.

- 310 No fill shall be placed over the root spread of any tree or shrub that is to be protected in the above manner until the required depth of porous material has been placed.

622.15 Pipe Underdrains

Pipe underdrains, when shown on the plans or directed, shall be placed to drain tree wells or porous material for tree root protection. These shall be placed in accordance with applicable provisions of 718.

622.16 Damage to Plants

- 320 During all operations of tree protection, care shall be used to prevent unnecessary cutting of roots and to prevent scarring or damage to selected trees or shrubs. Motorized equipment shall not be operated within the drip line of trees unless permitted. Where trimming of branches or cutting of roots is necessary, all cuts shall be made cleanly with proper sharp tools in accordance with generally accepted horticultural practices. Scarred areas and cut surfaces 3/8 in. (10 mm) or more in diameter shall be covered completely with a tree wound dressing.

622.17 Grass and Weed Control

- 330 Weeding and mowing of grass in and around all group plantings, beds, and individual trees and shrubs shall be performed until final acceptance. The grass and weed control areas shall be the areas within 2 ft (0.6 m) of the outer limits of all group plantings and shrub beds and within 2 ft (0.6 m) of the outer limits of the mulch area of individual shrubs. For the care of individual trees, the area shall extend to a perimeter centered from the point itself to 2 ft (0.6 m) beyond the stub stakes of the guy wires or 2 ft (0.6 m) beyond the mulched area. In general, these areas shall be in accordance with the plans.

622.18 Care, Inspection, and Replacement

- 340 **(a) Care**

Watering, fertilizing, weeding, cultivating, spraying to control insect infestation and disease, and all other good horticultural practices necessary to maintain the plants in a living healthy condition shall be performed up to the time for termination of responsibility for care as set out herein. The plants shall be cared for throughout the life of the contract. All plants stolen, damaged, or destroyed by fire, automobiles, vandalism, or any other cause, with the exception of plants damaged or destroyed by Department maintenance operations, shall be replaced with no additional payment as soon as practicable. Plants damaged or destroyed by the Department will be replaced by the Department prior to the date of final acceptance.

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(b) Inspection and Replacement

On or about May 1, a spring inspection of initial plantings will be made during and before the end of the planting season and prior to the beginning of the establishment period. Plants not living, unhealthy, in a poor growing condition, or otherwise not meeting the specifications shall be replaced with no additional

payment, prior to May 15 for trees and prior to May 25 for other plants. These replacements shall be in accordance with all other requirements of the initial planting. All plants found to be not living or in an unhealthy condition between this replacement and final inspection shall be removed from the project immediately, as directed, and shall be replaced after September 15 as detailed below.

A fall inspection will be made on or about September 15, at which time the condition of the materials planted within the specified planting season will be determined. At the time of this inspection, all plants which are found to be dead, unhealthy, in a poor growing condition, or otherwise not meeting the specifications will be rejected. Rejected plants shall be removed and disposed of as soon as practicable and replaced prior to November 15 with no additional payment. Replacement materials and operations shall be in accordance with the requirements of the initial planting.

A final inspection of the contract will be made as soon as possible after replacement. All plants shall be cared for and maintained until final inspection and acceptance.

All seedlings for wildlife habitat shall be in accordance with ASNS Seedling Trees and Shrubs and will be inspected by a landscape architect within one week of planting. Spring and fall inspections as described above will not be required. The inspection, planting, and maintenance of seedlings as required will constitute final acceptance.

622.19 Crown Vetch Plants and Seedlings

The requirements of 622.09 and 622.18 will not apply to these items. Seedlings shall be fertilized as specified on the plans. Crown vetch plants and seedlings, including replacements, shall be watered as necessary to keep them in a living, healthy, and good growing condition.

On or about June 5, these items will be inspected. If it is estimated that 90% or more of the plan quantity of any individual item in a specific area is living, healthy, and in a good growing condition, replacements will not be required. If less than 90% are alive, healthy, and in a good growing condition, all items not meeting these requirements shall be replaced. Replacements shall be marked in the same manner as the original planting, except the markers shall be yellow.

Replacement planting shall be accomplished prior to June 15.

A final inspection will be made on or about the following September 15. If it is estimated that 90% of the contract quantity of any individual item is living, healthy, and in a good growing condition, payment will be made for the contract quantity. If less than 90% meet these requirements, the pay quantity for the item will be established.

622.20 “Do Not Mow or Spray” Signs and “Do Not Disturb” Signs

These signs shall be placed at the boundaries of areas where seedlings for wildlife habitat have been placed. The locations and spacing of the signs shall be as shown on the plans or as directed. The sign shall otherwise be in accordance with 621.06(h).

622.21 Method of Measurement

410 Furnishing and planting trees, shrubs, and vines will be measured by the number of units of each type and size specified, installed, and accepted. Seedlings for wildlife habitat, “Do Not Mow or Spray” signs, and “Do Not Disturb” signs will be measured by the number installed and accepted. Retaining wall masonry, either mortared or not mortared as specified, will be measured by the cubic yard (cubic meter). Porous material for root protection will be measured by the ton (megagram). Drain tile will be measured by the linear foot (meter).

622.22 Basis of Payment

420 The number of trees, shrubs, and vines of each variety planted, determined as provided above, will be paid for at the contract unit price per each for plant, of the type, form, and size shown in the Schedule of Pay Items. Seedlings for wildlife habitat, “Do Not Mow or Spray” signs, and “Do Not Disturb” signs will be paid for at the contract unit price per each.

Masonry wall and masonry tree well will be paid for at the contract unit price per cubic yard (cubic meter). Porous material for root protection will be paid for at the contract unit price per ton (megagram). Drain tile will be paid for at the contract unit price per linear foot (meter) of the diameter specified.

Payment will be made under:

430

Pay Item	Pay Unit Symbol
Drain tile, _____ in. (mm) diameter	LFT (m)
Masonry Wall	CYS (m3)
Masonry Tree Well.....	CYS (m3)
Plant, Annual	EACH
Plant, Aquatic	EACH
Plant, Biannual	EACH
440 Plant, Broadleaf Evergreen, Cone, Broad Upright, _____ size	EACH
Plant, Broadleaf Evergreen, Globe, Dwarf, _____ size	EACH
Plant, Broadleaf Evergreen, Spreading, Semispreading, _____ size	EACH
Plant, Coniferous Evergreen, Cone, Broad Upright, _____ size	EACH

622.22

	Plant, Coniferous Evergreen, Globe, Dwarf, _____	EACH
	size	
450	Plant, Coniferous Evergreen, Prostate Broad Spreading, Semispreading, _____	EACH
	size	
	Plant, Deciduous Shrub, _____	EACH
	size	
	Plant, Deciduous Tree, Multi-Stem, _____	EACH
	size	
	Plant, Deciduous Tree, Single Stem, _____	EACH
	size	
	Plant, Ground Cover	EACH
460	Plant, Perennial.....	EACH
	Plant, Root Tuber, Corm, Bulb.....	EACH
	Plant, Rose Grade	EACH
	Porous Material for Root Protection.....	TON (Mg)
	Seedling	EACH
	Sign "Do Not Disturb"	EACH
	Sign, "Do Not Mow or Spray"	EACH

The cost of furnishing all materials, labor, and necessary incidentals shall be included in the cost of the pay items.

470

Progress payment for planting trees, shrubs, or vines will be based on the premise that 75% of the work has been completed when such trees, shrubs, or vines have been completely planted. The remaining portion of the payment will be for maintenance and plant replacement.